



Department of Agriculture and Marketing

1986

**RESEARCH AND
INNOVATIVE DEMONSTRATION
REPORT**

RESEARCH AND INNOVATIVE DEMONSTRATION COMMITTEE - 1986

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1986 Statistical Summary

Research projects were funded from a number of sources. Some of these were at the discretion of the Committee while others were the result of individual initiative. A number of investigative projects are not included. The fund sources are as follows and may or may not be included in these statistics.

<u>Source</u>	<u>Projects/ Grants</u>	<u>Funds \$,000.</u>
N. S. Dept. of Agriculture and Marketing	35	185,
Agriculture Canada	3	40,
NSERC	11	246,
Industry Contracts and Grants	21	131,
Canada-Province Development Agreement	10	221,
	80	823,

Readers are encouraged to contact the project leaders for further information. Inquiries concerning the overall program may be made through any committee member.

1986 RESEARCH PROJECT REPORTS

<u>Project Number</u>	<u>Project Leader</u>	<u>Project Title</u>
86-01	H.-Y. Ju	European Canker Control of Apple Trees
86-02	D. M. Anderson	Nutritional Evaluation of Crab Meal
86-03	M. G. Sampson	Integrated Control of Canada Thistle
86-04	D. Allen	Earth Tube Heat Exchangers
86-06	J. S. Bubar	Cereal and Protein Crops
86-07	J. S. Bubar	Forage Crops
86-08	A Madani	Subsurface Drainage System Performance Study
86-09	D. Mellish	Cereal Rate of Seeding Trial
86-11	R. A. Murray	Evaluation of Grape Cultivars and Trellising Systems
86-13	W. DeWitt	Survey of Antibodies and Persistence of Antibodies to 4 virus diseases in broiler chicks as detected by the E. L. I. S. A. technique
86-14	D. M. Anderson	Effects of Post Harvest Drying of Cereal Grains
86-16	M. L. Connor	Fox Production and Reproduction
86-19	M. N. Rifai	FMC Carrot Harvester Modification
86-20	M. G. Sampson	Blueberry Weed Book
86-21	M. L. Connor	Melatonin and Reproduction in Furbearers
86-22	N. L. Firth	Chicken Fat in Pig Feeds
86-24	T. H. Haliburton	1986 Vegetable Variety/Management Trials
86-25	R. K. Prange	Clonal Selection and Propagation of the Ostrich Fern
86-26	L. J. Eaton	Nutrition and Management of Lowbush blueberries
86-27	A. H. Fredeen	Evaluation of Hydrochloric Acid-

		Treated Direct Cut Silage for Dairy Cattle
86-28	L. R. Mapplebeck	Differential Susceptibility of Crop Cultivars to Herbicides
86-30	H. -Y. Ju	American Ginseng Production in Nova Scotia
86-45	D. M. Anderson	Digestibility Studies Using Atlantic Canada Feedstuffs
86-46	R. W. Daniels	Turfgrass Evaluation and Management
86-51	D. C. Crober	Computerized Environmental Control and Flock Management System
86-52	M. G. Sampson	Quackgrass Biotypes
86-53	A. B. Gray	Winter Wheat and Barley Diseases
86-66	M. L. Connor	Determination of Gonadotropic Hormones by Radioimmunoassay
86-67	A. R. Robinson	Corticosterone Levels and Layer Performance
86-68	J._P. LeBlanc	Effect of Temperature on Predatory Mites on Apple
86-69	A. R. Olson	Test Tube Pollination of Cultivated Potatoes
86-70	J. Nowak	Germplasm Preservation by Freeze-Drying Potato and White Clover
86-73	P. R. Warman	Effects of Fertilizers and Soil Properties on Asparagus Yield and Nutrition
86-74	H.-Y. Ju	Growth Regulator Studies on Lowbush Blueberry
86-77	T. Tennessen	Improving Cage Design for Laying Hens- Stage 2
86-80	A. H. Fredeen	Effect of Dietary Calcium Source and Amount on Blood Mineral Profile and Incidence of Parturient Paresis
86-81	K. G. Grant	Price Forecasting and Hedging by Maritime Feed-Grain Industry
86-83	D. L. Patterson	Strain Differences and Prediction of



		Carcass Fat in Broiler Chickens
86-84	D. M. Anderson	Wet Versus Dry Feeds for Growth, Lactation and Reproduction in Foxes
86-86	D. C. Crober	Strain and Housing Effects on Caged Layers
87-75	J. C. Miller	Direct, ³ Rapid Assay for Tritiated Water (³ HOH) in Soil Samples
	A. H. Fredeen	Evaluation of Kale Pasture for Beef Cows in Late Pregnancy
	D. C. Crober	Use of Artificial Insemination in the Production of Hatching Eggs
	D. C. Crober	Use of Intermittent Lighting for Commercial Layers
	W. G. Mathewson	Accelerated Lamb Production Using Light Control
	K. G. Grant	Free(r) Canada-United States Trade and Atlantic Canada's Agriculture
	M. G. Sampson	Herbicide Screening in Barley, Soybean, Corn, Blueberries, and Fallow
	M. G. Sampson	The Development of an Integrated Weed Control Program in Barley for <u>Agrophon repens</u> (L.) Beauv. (Quackgrass) - A Systems Approach
	J. C. Lewis H.-Y. Ju	Effects of Plant Growth Regulators on Growth of Lowbush Blueberry
	M. L. Connor	Puberty Induction and Ovulation Rate in Gilts
	A. H. Fredeen	Effect of Rate of Feeding Concentrates on Forage and Nutrient Intakes and Performance of Dairy Cows in Mid-lactation
	M. G. Sampson	Biological Control of Perennial Weeds in Nova Scotia
	J. Nowak S. Matheson N. MacLean	<u>In Vitro</u> Selection of Cold Stress tolerant Alfalfa
	K. S. MacLean	Effects of Applications of Sewage Sludge to Farm Lands on the Protein,

Organic Matter and Heavy Metal Contents

D. Northcott
J. Nowak

Application of Hydrogen Cyanamid for
Dormancy Breaking in Potato

R. G. Ackman
N. L. Firth

Pilot Test of Urea-Fish Oil Fatty Acid
Complexes in Ruminant Nutrition

J. Nowak
N. MacLean

Selection for Regeneration from Red
Clover Callus Tissue

H.-Y. Ju
J. Nowak

Effect of Boron Nutrition on
Glucosinolate Content in Crucifers

TITLE: European Canker Control of Apple Trees

LEADER: H.-Y. Ju

OBJECTIVE: To control European canker of apple trees and study of its infection pattern

PROGRESS: European canker caused by the fungus Nectria galligena was identified on apple trees in the college orchard. This was of great concern because the disease has been found to be very destructive. The two rows of McIntosh apple trees grafted on M9 and M7 rootstocks showed severe infection. Recently the disease has spread to the young apple trees planted between 1975 and 1981. Prior to treatment for canker control, the apple trees were examined so that the pattern of infection in the orchard could be determined.

The 86 trees (58.9%) from the 146 trees planted between 1975 and 1981 were infected with an average of 2.2 cankers per infected tree in this group. Average canker size was 6.2 cm in length and 3.4 cm in width. The cankers were found at 67.5% on the trunk, 21.3% on the scaffold limbs and 11.2% on other branches. The 11.2% represents cankers which could be removed by light pruning. Inspection of the cankers revealed that canker infections were originated by 61.2% from a leaf scar infection, 14.4% from narrow crotch angles, 11.2% from pruning cuts, 5.8% from frost cracks and 7.4% from miscellaneous modes of entry such as burr knots, tree support rubbing the bark and unidentified factors. The majority of these cankers (87.9%) were classified as active; that is, the fungus was actively colonizing the tree.

Infected trees were treated by cutting out the diseased wood in an elliptical shape around the canker and painting the area with a mixture of Benlate and PVA paint at a rate of 50 g a.i. per liter of paint. After 4 months these wounds appeared to be healing well, with approximately 1 cm of regrowth around the periphery of the wound. These wounds should be inspected in 1987 to ensure they are healing properly.

It is necessary to monitor the orchard in the future and to treat any cankers which may develop in the manner described above. This project was the first demonstration of European canker control in a Nova Scotia orchard and should be useful to commercial apple growers.



Project 86-02

TITLE: Nutritional Evaluation of Crab Meal

LEADER: D. M. Anderson

OBJECTIVE: To examine the range of nutrients in crab meal samples collected during the 1985 processing year to establish guidelines for incorporation of these into diets for monogastric animals. To determine the digestibility and protein quality of samples of crab meal from the 1985 processing year to facilitate more accurate utilization of crab meal in diets for monogastric animals.

PROGRESS:

Crabmeal is considered to vary in protein quality from sample to sample. The protein quality of 10 samples of crabmeal, from different production batches and from one of two sources (National Sea Products and W. E. Acres), was determined using both in vitro and in vivo procedures to correlate the responses among the procedures.

A. Rat Bioassay

1. Growth Trial

One hundred and twenty-one individually housed, 3 week old, Sprague-Dawley rats were randomly assigned to diets. For 3 weeks rats were fed ad libitum with Protein efficiency ratio (PER) type diets formulated at 10% crude protein using crabmeal sample or casein as the protein source. Weekly weight gains and feed consumption were used to determine rate of gain, feed consumption and PER.

2. Digestibility Trial

Seventy-two rats (7 weeks of age) were placed in groups of 4 in 18 wire mesh cages (weight of rats per cage approximately 80g) and fed diets containing 0, 10, or 20% crabmeal, with the remainder of the diet consisting of a protein free basal diet. Fecal collections were made until 40 grams was collected per cage.

Crab meal diets, feed and feces samples were dried, ground and retained for subsequent analysis of crude protein, dry matter, chromic oxide and gross energy. Digestibility coefficients were calculated for dry matter, crude protein and gross energy.

B. In Vitro Pepsin Digestibility

The in vitro method involved incubating samples of crab meal with the enzyme pepsin under conditons simulating gastric digestion. The residue of the digestion was used to determine the amount of undigested protein in the crab meals and hence Pepsin digestibility.

Comparison of the protein quality of crab meal samples from animal growth (Table 1) indicated that the poor growth rate as indicated by PER in rats was partially due to poor digestibility of the protein from crab meal. PER ranged from 0.24 ± 0.79 for various crab meal samples while protein digestibility ranged from 17.5% to 47.8%. Pepsin digestion of the crab meal samples showed a similar range 13.3% to 51.2% for digestibility although there appeared little relationship between values obtained on the pepsin digestibility compared to the in vivo protein digestibility. The extremely large variation and low values obtained for protein digestibility of crab meal are important in estimating the value of crab meal for use in diets for monogastrics.

Table 1. Protein Quality of Crab Meal Samples Using Growth, In Vivo Digestibility and Pepsin Digestion

Crab Meal Sample	P.E.R. **	Protein Digestibility (%)	Pepsin Digestibility (%)
1	$0.39 \pm .03$	17.5	31.4
2	$0.34 \pm .05$	25.9	13.3
3	$0.28 \pm .07$	20.9	24.0
4	***	25.1	29.8
5	$0.73 \pm .13$	47.8	44.5
6	$0.79 \pm .12$	41.2	32.7
7	$0.75 \pm .12$	42.5	30.3
8	$0.70 \pm .10$	34.4	46.3
9	$0.45 \pm .06$	30.8	30.3
10	$0.24 \pm .07$	23.2	51.2

* Casein diet used as control had a PER = $2.49 \pm .09$ and protein digestibility of 90.7%.

** P.E.R. Protein Efficiency Ratio

*** All rats lost weight, therefore the P.E.R. was not determined.

TITLE: Integrated Control of Canada Thistle

LEADER: M. G. Sampson

- OBJECTIVES:
1. To evaluate an integrated management program for Canada thistle in pastures.
 2. To evaluate the potential of the herbicide Clopyralid (LONTREL) for Canada thistle control in pastures.
 3. To evaluate the rust, Puccinia punctiformis and other organisms to use as a biological control.

PROGRESS:

Field Experiments:

Two experiments were set up in 1986 to evaluate different combinations of herbicides and mowing regimes. One site was in Eastville, Colchester County and the other was in Alberry Plains, Prince Edward Island. The experimental design was a split-plot factorial experiment with six levels of mowing had two rates of herbicides as well as a control without herbicides. Main plots were mowed in spring, mowed at flowering, mowed in late summer, mowed twice (spring and at flowering) and mowed three times (spring, flowering, late summer). Plots were also left unmowed as a control. In Eastville, the herbicide treatment was 2,4-D + Dicamba; in Alberry Plains Clopyralid was used. Results indicated that all treatments except, for spring mowing, did suppress Canada thistle when compared to untreated plots. In Eastville, there was regrowth from most treatments, indicating that the weed will still be a problem next season. The fall mowed treatments, however, cannot be evaluated for control until next spring. In Prince Edward Island, however, there was no regrowth in any plots sprayed with the herbicide Clopyralid. Again, the fall mowed treatments cannot be evaluated until spring 1987. Clopyralid, however, appears to be an excellent alternative to the use of 2,4-D + Dicamba.

Biological Control:

Investigations were conducted to determine the level of the rust, Puccinia punctiformis, in the field. In 1986, levels of the rust were low initially but by the end of the season, high levels of the rust were found. All attempts to cause a systemic infection in artificially inoculated plants failed. However, attempts will continue.

Investigations with the gall insect Urophora cardui indicate that the insect has survived its second winter in Nova Scotia and Prince Edward Island. However, because of weather conditions, population levels were low. Damage levels were also low.

Work plan for 1987:

All experiments will be repeated in 1987. In addition, weed control ratings and densities have to be recorded on those experiments established in 1986 to determine the effect of winter-kill on the plants as a result of the

mowing treatments. Investigations into the effectiveness of biological control agents will continue. In addition, the level of parasitism of U. cardui by various parasites will be assessed at the Eastville site.

Results with the herbicide Clopyralid will be monitored closely as this herbicide appears to be able to fill the gap if 2,4-D is removed from the market. More research, however, is required to provide enough information for registration.

Project 86-04

TITLE: Earth Tube Heat Exchangers

LEADER: D. Allen

OBJECTIVE: To purchase components and install an earth tube heat exchanger to supply thermally modified air both summer and winter to the farrowing facility NSAC swine unit. To test the effectiveness of earth heat exchangers in a Nova Scotia climate and to determine minimum depth requirements and maximum effective pipe velocities.

PROGRESS:

For the purpose of the measurement three 250 mm and 30 m length corrugated plastic drainage pipes were placed 2.7 m below ground surface. The tubes were connected to an intake manifold at the outboard end and a supply manifold at the supply or building end. The supply manifold was connected to the intake duct of the farrowing room of the NSAC swine unit. All above ground structures were finished and painted white. A sump connection was provided to the supply manifold for removal of any water that may enter the system.

A data logger was put in place for a one week duration in January for the purpose of measuring air temps. through the system. It was found at this time that the low winter air flow would not cause any intake air to pass through the earth tubes.

As a result of this revelation the project is being modified somewhat such that a delivery fan will be placed within the earth tube supply duct for positive ventilation of the tubes. Suitable modification will be made to the controls and air intakes of the existing and modified ventilation system. This work is scheduled for the summer of 1987.

TITLE: Cereal and Protein Crops

LEADER: J.S. Bubar

OBJECTIVE: To support the breeding programs aimed at developing grain crops for the Atlantic Region. To evaluate cultivars for recommendation and licensing. To support other research and development projects by carrying out other small plot trials that are requested by Atlantic Advisory committee members.

PROGRESS: This project is co-ordinated under the Atlantic Advisory Committee on Cereal and Protein Crops. The following trials were conducted in 1986 and results appear in the appropriate regional or national report.

- 1) Eastern Co-operative two-row barley test
- 2) Eastern Co-operative six-row barley test
- 3) Maritime barley screening test
- 4) Maritime Co-operative oat test
- 5) Eastern Co-operative spring triticale test
- 6) Maritime spring wheat screening test
- 7) Maritime-Quebec spring wheat test
- 8) Regional short season soybean trial

Early and rapid seeding of the cereal trials, that is possible with the mechanization we now possess, resulted in high yields and low coefficient of variability. We were also able to complete most of the work before students returned to classes in the fall, in spite of poor harvest weather. We had, for the first time, an entry in a yield trial that exceeded 8000 kg/ha.

The co-operative trials in which we participated resulted in:

- 1) A new barley (AB73-3) proposal for registration
- 2) Support for registration of King Agro's new barley that is considered suitable for malting in Europe that may be grown in the Atlantic region.
- 3) Recommendation of Cadette barley in the Atlantic region
- 4) Recommendation of Maple Ridge soybeans in the Atlantic region
- 5) Recommendation of Nova oats in the Atlantic region
- 6) Recommendation of Beaquelita spring triticale
- 7) Recommendation of Decade winter triticale
- 8) Recommendation of OAC Trillum winter triticale.

Assistance of a student supported by the "Challenge 86" program, Employment and Immigration Canada, was used to supplement the support obtained from the N.S.D.A. and M. Research and innovative Demonstration committee to permit us to meet most of the objectives of the project within the limits of the funds granted.

TITLE: Forage Crops

LEADER: J.S. Bubar

OBJECTIVE: Evaluation as required by the Advisory Committee on Forage Crops to meet needs for crop recommendation and for registration of new cultivars

PROGRESS: Details on trials in which we participated are recorded in the 1986 Forage Evaluation Report of the Advisory Committee on Forage Crops, Atlantic Committee on Crops (this report is distributed from N.S.A.C. by J.S. Bubar).

These trials are co-ordinated by the members of the Forage Evaluation sub-committee, ACFC. The recent series of red clover trials in which we participated resulted in registration of three new red clover cultivars that will be recommended in the Atlantic region - Marino, Tapiopoly and Jubilatka. Fescue trials resulted in registration of Johnstone tall fescue.

TITLE: SUBSURFACE DRAINAGE SYSTEM PERFORMANCE STUDY

LEADER: A. Madani

OBJECTIVE: To evaluate the performance of a subsurface drainage system on a Queens soil type

PROGRESS:

The objective of the research is to monitor the water table drawdown and outflow (discharge) from tile drainage plots made up of 6, 12, and 24 m spacings. Due to problems of locating the tiles and a relatively wet summer, work was delayed until the crop (corn) was harvested. Then, a small backhoe was brought to the site to assist in locating the tiles. This proved very successful and the center two laterals from each plot were located.

The plot area was surveyed by a soils specialist and a soil map was prepared for the site. There was not a homogeneous soil present for the entire site, but the majority of it consisted of Queens and Debert with a shallow compact till layer between 30 to 50 cm. Water table measuring tubes (perforated) were placed in each plot. There was a total of 10 tubes placed in each plot. These tubes consisted of five at 50 cm in length and five at 100 cm in length. The shorter tubes were placed at five locations between the center two laterals. The locations were (1) next to the drain, (2) $1/3$ the spacing, (3) $1/2$ the spacing, (4) $2/3$ the spacing and (5) next to the other center lateral. The shorter tubes were placed in each plot to monitor the presence of a perched water table.

The longer tubes were placed at the same location between the center two laterals and approximately 1 meter from the shorter tubes. These tubes were placed to monitor the water table drawdown between the laterals due to the tile drainage.

Upon installation of these tubes, the site was surveyed to record the elevation of each tube and the ground contour.

The tubes were then monitored 3 times in the late fall and the depth from the top of the tube to the water table was recorded. Data indicated the presence of a perched water table.

The amount of data collected in the late fall were limited due to the onset of cold weather and the formation of ice in the tubes. Also data were limited due to the small amount of precipitation received after the tubes were installed.

In order to effectively evaluate the performance of the drainage system, more data are needed. This spring and fall,

depth to the water table will be recorded in the above mentioned tubes as a function of time to determine the water table fluctuations and drawdowns for each drain spacing. At the same time the outflow from the drains will also be measured.

TITLE: Cereal Rate of Seeding Trial

LEADER: Dwane Mellish

OBJECTIVES: To evaluate the response of five grain species to a range of seeding rates while utilizing disease suppression and lodging control practices.

PROGRESS:

Seeding rate studies have been conducted in the past and have shown little advantage in increasing seeding rates beyond a moderate level. However in these trials no effort was made to control lodging or disease pressure which become larger factors as crop density increases.

In 1986 the first year of a three year study looking at the response of spring cereals to increased seeding rate when both disease and lodging pressure is reduced was begun. Leger, 6-row barley; Rodeo, 2-row barley; Max, spring wheat; and Beaguelita spring triticale were planted at 100 seeds/m² to 600 seed/m² in 100 seeds/m² increments.

Disease levels were moderately well controlled and no lodging occurred.

Plants/m² increased as expected with rate of seeding except for the Max where less than expected plant numbers established at the higher seeding rates.

Rodeo and Beaguelita accomplished their maximum head population at the 200 seeds/m² seeding rate. Leger showed less tillering ability and it did not reach its maximum head population until the 400 seeds/m² seeding rate. The Max did not reach an acceptable head population and there was no significant effect due to seeding rate.

Beaguelita and Max reached the maximum grain yield at a seeding rate of 400 seeds/m², Rodeo at 300 seeds/m² while Leger accomplished its maximum at 500 seeds/m². Using an average 100 kernel wt. of 35 gms/100 this would mean seeding rate in kg/ha for Beaguelita and Max of 140 kg/ha, Rodeo 105, and Leger 175 kg/ha.

The lack of plant establishment by the Max and subsequent lack of response to seeding rate suggests caution in drawing conclusions from this data after one year. The trial will be continued for two years to build a better data base.



TITLE: Evaluation of Grape Cultivars and Trellising Systems

LEADER: Robert A. Murray

OBJECTIVE: To evaluate five hybrid and vinifera grape cultivars using two trellis systems, a 4-Cane Kniffen system and a low cordoned spur pruned cage system.

PROGRESS: The following cultivars were selected for the Grape Cultivar Project being conducted on the R. D. Corkum farm, Upper Falmouth (Dyke Road) Hants County.

G.M. 316-57 - 40 vines	Hybrid - white
G.M. 318-57 - 40 vines	Hybrid - white
G.M. 312-58 - 40 vines	Hybrid - white
G.M. 324-58 - 50 vines	Vinifera - red

Guard Rows

Kerner	- 25 vines	Vinifera - white
Siegfried (SF-4)	- 65 vines	Hybrid - white
Okanagan Riesling	- 72 vines	Hybrid - white

Pre-Planting: In May, 1986 underdrainage was installed at 24' spacings. Roundup had been applied, and the area plowed the previous fall (1985). The area was disced and the row area rototilled.

Planting: The trial vines were planted June 22. The three guard rows were planted on July 1, 1986. Black plastic mulch was used in the guard rows for weed control.

Spacings - 5' between vines; 8' between rows.

The vines were set out one variety to a row. The vines were not set out in replicate.

Spray Program: Micro-fine sulfur was applied at 1/2" and 1 1/2" of growth followed by regular sprays at 15 day intervals until August 32. A final spray of captan was applied October 18. No signs of downy or powdery mildew were evident. No insecticides were applied.

Weed Control: Weeding was done by hand hoeing around vines and clean cultivating between rows with a cultivator.

Trellis System: 4' galvanized stakes, 1 per vine were installed at time of planting. The stakes for those vines being trained to the kniffen system will be replaced by 8' stakes when the trellising is installed.

Posts were installed April 19, 1987 at 25' spacings. Posts are black spruce dipped in Creosote.

The proposed trellis systems to be installed in May, 1987 are a 4-Cane Kniffen system and a low cordoned, spur pruned cage system. Each cultivar will be trained to both systems to evaluate winter hardiness, production, grape quality and suitability of trellising system for particular cultivar.

#11 gauge galvanized crimped wire will be used in both systems for securing the stakes. 1.2 mm stainless steel wire will be used for the caging wire, and #12 gauge H.T. galvanized wire for the second wire of the kniffen system. The trellising is expected to be completed by the end of May 1987.

Winter Survival: In October, just prior to the first major frost that killed all leaves, the growth and woodiness of the cultivars in the trial rows as well as in the guard rows were evaluated.

The vine's growth was evaluated on the basis of "good" being growth to the top of the 4' stake or beyond, fair being more than 2' of growth but not to the top of the 4' stake and poor being less than 2' of growth.

<u>Cultivar</u>	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>Dead</u>	<u>Remarks</u>
#316-57	25	10	5	0	Quite good wood.
#324-58	21	13	6	1	No bud ever emerged from dead vine. Cane fairly green.
#318-57	20	15	3	3	No bud emerged on dead vines. Good wood.
#312-58	6	23	11		Wood changing from green to brown.
Gamay	20	18	12		Fairly good wood.
Okanagan R.	13	23	36		No appearance of hardening off.
Siegfried	29	32	14		Hardening off fairly well.
Kerner	15	4	6		Hardening off well.

In late November all vines were covered with straw. The soil was too wet for hilling up around the vines, and then it froze solid.

A further evaluation will be made after bud-break to determine winter survival of the vines. A preliminary pruning of the vines on April 20 would indicate an excellent survival rate for most vines with some vines of the Gamay in question.

Temperature Data: Minimum-maximum recording thermometer will be established in the spring of 1987. Daily temperatures will be recorded.

Funding: Funding for this project from the Research and Innovative Demonstration is for the 1986-87 fiscal year. All labor costs and additional material costs will be the responsibility of the R.D. Corkum farm.

Project Duration: The project is expected to continue to 1992. Progress reports available upon request.

Project 86-13

TITLE: Survey of antibodies and persistence of antibodies to 4 virus diseases in broiler chicks as detected by the E. L. I. S. A. technique.

LEADER: W. DeWitt

OBJECTIVE: To determine the persistence of maternal (passive) antibody against 4 avian virus diseases in broilers and the appearance of active immunity to these same and other virus diseases so that vaccinations or other means can be used to lessen their impact. Antibodies whether active (disease or vaccination induced) or passive (maternal) can be detected in avian (broiler) blood by means of the E. L. I. S. A. (technique).

PROGRESS:

Ten broiler flocks originating from two hatcheries and controlled by two separate production operations (A & B) located in Kings County, Nova Scotia, were examined serologically.

Fifteen blood samples (May-August, 1986) were collected from each flock, commencing at day 1 and at approximately weekly intervals until thirty-five days of age, with the exception of one flock which was extended to sixty-two days.

Production operations A & B had three and two flocks involved in the first test and the reverse order followed in the second test. Five flocks were sampled each period and live chicks or bloods were transported to the laboratory in Truro. Serum was collected approximately twelve hours later and immediately frozen for later examination.

When all sampling was completed, the serums were examined by the Enzyme Linked Immunosorbent Assay (E. L. I. S. A.) procedure for Newcastle Disease Virus (NDV), Infectious Bronchitis Virus (IBV), *Infectious Bursal Disease (IBD) and Reo Virus (RV). Flochek utilizing prepared plates and a computerized system was used to determine titre, variation, deviation and generate histograms for each set of samples. Six sets (15 per set) totaling 90 wells were utilized in each microtitre plate. Ninety tests for each virus was conducted on each flock giving a total of 360 tests per flock, and a grand total of 3600 tests for the ten flocks to thirty-five to thirty-nine days. An additional one hundred twenty tests were carried out on one flock extended to sixty-two days of age.

Results:

		<u>A</u> Days				
Virus	1	7-12	14-19	21-26	28-32	35-39
NDV	5179	2103	710	325	287	268
IBV	3298	998	329	184	323	396
IBD	3302	2092	5416	331	417	837
RV	1533	317	209	442	964	1294

		<u>B</u> Days				
Virus	2	7	14	21	28	35
NDV	8437	3715	760	460	719	599
IBV	3910	1292	498	522	542	611
IBD	4167	3119	1324	890	852	641
RV	2334	665	123	374	1051	2037

Extended Days		
Virus	52	62
NDV	143	724
IBV	112	2699
IBD	2206	4011
RV	2556	3734

Maternal antibodies to Newcastle Bronchitis decayed to a low level between seven and fourteen days and for Bursal Disease between fourteen and twenty-one days. Reo virus decayed between one and seven days. All flocks showed a rise in Reo titre at thirty-five days.

Two flocks in operation A had a rise in titre to Bursal Disease at thirty-five days.

One flock in Operation B had a rise in titre to Bronchitis at thirty-five days due to vaccination for this virus.

The flock extended to sixty-two days had a rise in titre to Infectious Bronchitis, Infectious Bursal Disease and Reo virus.

No clinical abnormalities, mortality or elevated condemnations were present.

Maternal antibodies are present in significant levels and for a sufficient period to offer protection to young chicks. Infectious Bursal Disease, Infectious Bronchitis are present in Nova Scotia broiler flocks, while Reo virus is prevalent.

* Agritech Inc., Fore Street, Portland, Maine, U. S. A.

Project 86-14

TITLE: Effects of Post Harvest Drying of Cereal Grains

LEADER: D. M. Anderson

OBJECTIVE: To evaluate the effects of drying at various temperatures 50-80°C on the nutritive value of wheat and barley fed to broiler chickens.

PROGRESS:

Recent trends in batch drying cereal grains has resulted in the use of temperatures in excess of the recommended for drying of grain for planting. The purpose of this experiment is to determine the possible changes in nutritive value of wheat and barley subjected to forced air drying at 50, 60, 70 or 80°C. These temperatures represent ranges that include temperatures in excess of those recommended for seed if germination rate is to remain high. Nutritive value of those grains may be adversely affected by the high drying temperature. Nutritive value of the cereal grains were determined in growth trials using weanling, Sprague-Dawley rats initially weighing 60 grams. Diets were formulated using the grains diluted to contain 10% crude protein to facilitate protein quality evaluations. Body weight gain, feed consumption and feed consumed per unit of gain were determined in addition to protein efficiency ratio. Rats were provided with the test diets for 3 weeks.

Weight gain, feed consumption and feed/gain by the rats were similar at all drying temperatures indicating that the degree of heat applied did not alter the feeding value. Protein quality as measured by protein efficiency ratio (PER) was unaffected by heat treatment. Differences in all parameters indicated that the quality of protein from barley was generally better than from wheat.

The results indicate that protein quality as reflected by PER and growth rate were unaffected by drying barley or wheat grain at 80°C. If commercial batch dryers achieve a temperature of up to 80°C uniformly throughout the batch of grain, the feeding value will not be adversely affected.

TABLE 1. PERFORMANCE OF 3 WEEK OLD WEANED SPRAGUE-DAWLEY RATS PROVIDED WITH DIETS CONTAINING BARLEY OR WHEAT DRIED POST HARVEST AT VARIOUS TEMPERATURES

Cereal	Drying Temperature (°C)	Total Weight Gain		Total Feed Consumption		Feed:Gain		Protein Efficiency Ratio	
		Mean (g)	S.D.	Mean (g)	S.D.	Mean	S.D.	Mean	S.D.
Barley	50	42.95	9.830	259.72	30.022	6.28	1.330	1.64	0.264
Barley	60	38.70	9.989	251.32	17.608	6.95	2.014	1.52	0.335
Barley	70	39.61	7.181	250.15	24.506	6.47	1.084	1.58	0.226
Barley	80	44.71	9.231	267.07	20.514	6.16	1.122	1.67	0.284
Wheat	50	28.88	4.098	228.14	17.819	7.99	0.793	1.26	0.117
Wheat	60	29.89	6.612	239.78	27.300	8.23	1.163	1.24	0.172
Wheat	70	29.38	7.771	232.44	33.142	8.26	1.702	1.25	0.229
Wheat	80	34.02	6.467	234.45	14.708	7.12	1.428	1.45	0.239
Control		65.39	14.862	261.33	34.050	4.12	0.624	2.47	0.310

TITLE: Fox Production and Reproduction

LEADER: M. L. Connor

- OBJECTIVES:
- (a) To increase expertise in semen collection and Artificial Insemination (AI) techniques for foxes.
 - (b) To compare AI techniques, and the reproductive performance of vixens bred by AI vs natural mating.
 - (c) To investigate and evaluate methods of semen processing for fresh and freezing of fox semen.
 - (d) To contribute to investigations into fox production by helping maintain a viable Fox Unit at the N. S. Agricultural College.

PROGRESS:

Twice weekly semen collection from male silver fox extended the period of viable semen production several weeks beyond that of males used only for natural mating. Routine collections and testicular diameter measurements were taken from 4 adult and 3 pup dogs from mid-January to late March. Due to the scheduling for facilities, freezing of selected samples could be done only once per week. Testicular diameter increased to early February, plateaued, then declined throughout March to a size equal to or smaller than in Mid-January. Considerable variability was noted between males in testicular diameter, semen quantity, quality and freezability. The adult males tended to produce poorer quality semen than the pups. Two of these dogs had produced high quality semen last year which had good post-thaw motility. This years samples from these two were considerably inferior. The length of the reproductive season varied between individuals. For all dogs used, semen quality, especially motility was declining by March 24.

By early April only two pups and one adult were giving sperm rich fractions. In the pups it was only a few drops of relatively poor quality. None of the dogs gave semen samples past April 11. Sperm concentration of ejaculates ranged from 57.6×10^6 from a poor donor to 1475×10^6 sperm/ml from one of the better males.

Whelping results from vixens artificially inseminated are not complete at this writing. Using fresh semen extended with EYC 7/9 (78%) vixens whelped an average of 4.4 pups. With the second extender used (CUE+) so far only 1/6 whelps have occurred. Palpation of the cervix of 4 vixens indicated insemination was being done later than optimum time on these animals. Complete results will be forthcoming.

Microscopic examination of semen samples frozen during the 1986 breeding season demonstrated wide variation in post-thaw survival depending on time of season the sample was collected and

on the donor male. Generally, early to mid-season samples from young males produced the best results. At this writing one vixen inseminated with semen frozen in 1986 whelped three pups. The others inseminated have not come due yet. These results demonstrate that local freezing techniques can produce viable silver fox semen. Future work will more clearly define some of the limitations.

Additional investigations supported in part by these project funds included behavioural studies. A trial to determine whether a brief period of early handling of pups facilitated later production performance and ease of handling was begun. While some animals are obviously much easier to work with, the final results in terms of growth and fur production parameters have yet to be fully assessed.

TITLE: FMC CARROT HARVESTER MODIFICATIONS

LEADER: M. N. RIFAI

OBJECTIVE: To modify the FMC Carrot Harvester by using sensors to replace the operator control.

PROGRESS:

The most extensively used coarrot harvester in Nova Scotia is manufactured by the FMC Corporation in the United States. This harvester was modified by using electronic micro-switches and electro-hydraulic control valves in order to incorporate row tracking and automatic header height control to increase the efficiency of the harvester and to eliminate the need of the operator control.

It was found from the field tests that more flexible row tracking sensors are required to withstand the impact and the control system requires further modifications to eliminate problems of plugging.

Probably the most significant achievement reached by this modification is that the operator could completely control the harvester functions from the tractor using the control panel.

TITLE: Blueberry Weed Book

LEADER: M. G. Sampson

OBJECTIVE: To prepare a draft copy of a blueberry weed identification booklet.

PROGRESS:

A rough draft of a blueberry weed identification manual has been prepared. This booklet contains botanical descriptions of fifty important blueberry weeds as well as information on the distribution of the weed and its response to control measures. There is a line drawing of each weed demonstrating the mature plant as well as notable characteristics associated with various plant parts. There is also an introduction on the weed situation in blueberries and a glossary explaining terms used in the botanical descriptions of the weeds.

This booklet requires final editing before it is ready for printing. It is hoped that the final copy of this booklet will contain descriptions of all weeds that are contained in the blueberry weed garden at the Blueberry Institute in Debert, N.S. There are color slides of each of these weeds available but due to financial constraints, the inclusion of color photographs in the booklet is prohibitive.

Project 86-21

TITLE: Melatonin and Reproduction in Furbearers

LEADER: M. L. Connor

OBJECTIVES:

1. To evaluate the efficacy of melatonin implants for enhancing furring out in mink and foxes.
2. To compare animals implanted with melatonin to those furring in natural conditions in a shed and those kept under very low (40 lux) illumination.
3. To investigate the effect of melatonin implants on subsequent reproductive performance in fox and mink.

PROGRESS:

The comparisons were made using 60 fox pups and 40 mink kits at the N. S. A. C. Fur Unit. Twenty animals from each specie were implanted with melatonin implants in early July. The same number of controls were monitored under natural pelted shed lighting and twenty foxes were maintained under low light (≤ 40 lux) conditions.

Implanted mink were prime and pelted October 23 and foxes October 27 and November 6. These were 4 to 6 weeks before the control animals were ready for pelting. The size, fur density and texture were equal to controls. Of the fox pelted only 1/10 was graded slightly off in clarity. Otherwise the size and quality were similar to controls and average or above that of silver fox auctioned through the Hudson's Bay Fur Auction.

One of the major complaints and concerns about pelts from implanted animals was lack of clarity. This was not a problem with the foxes/mink in this study. It may be that with the accelerated furring of implanted animals there is also less time margin for optimum clarity. Implanted animals may need to be watched more closely and pelted promptly when prime is reached. The foxes kept under very low illumination were slightly ahead of the control animals in fur development. Most, however, were pelted with the control foxes.

It has been suggested that melatonin is antigonadotrophic to mink and fox and therefore implanted animals should not be kept as breeders. This was originally based on results of high dose implants. In the present study, histological sections made from tests at pelting showed spermatogenic activity from implanted males. Some implanted mink and fox were kept to monitor reproductive activity. In fox the males matured sexually more rapidly than controls - testicular development and secondary sex characteristics parallel their growth and furring enhancement. These males appeared to pass through their sexual season correspondingly early as well. The implanted female foxes appeared to be in

proestrus in early January. However, none of these three vixens was observed in estrus. Of the implanted mink retained 2/2 males mated normally and produced viable offspring. Similarly 3/4 females mated and 2/3 have whelped normal healthy litters at this writing and the other appears with kit. While the sample number is small the indications are clear that the melatonin either is not antagonodotrophic or that the current implants are at a dosage level not deleterious to reproduction. Blood samples taken throughout the study, as yet to be analyzed, and a repeat of the trial this year will help to better define the role of melatonin in mink and silver fox.

Project 86-22

TITLE: Chicken fat in pig feeds

LEADER: N. L. Firth

OBJECTIVE: To determine the suitability of chicken fat as an ingredient in pig rations.

PROGRESS:

Chicken fat is a by-product of the poultry processing industry which has little value. This project assessed its suitability as an energy source in pig rations. One hundred and twenty pigs were used in a feeding trial comparing chicken fat at 3 and 6%, with tallow at 3 & 6%, and with a base diet. All diets were fed ad libitum from 40 kilograms to market weight (90 kg). Feed intakes, growth rates and carcass grades were not statistically different among the treatments.

Complete taste panel assessment was not conducted but a roast from one animal, from the 6% chicken fat treatment, was cooked and offered to staff members for their comments which were uniformly favourable. Laboratory assessment will be completed on rancidity of fat and fatty acid composition from samples of one animal per treatment.

TITLE: 1986 Vegetable Variety/Management Trials

LEADER: T.H. Haliburton

OBJECTIVE: To compare the effect of cultivar, spacing, planting date and planting method on the performance of several minor vegetable crops

PROGRESS: Part 1. Chinese Cabbage (Brassica campestris, Pekinensis group)

Twelve cultivars (mainly hybrids) were compared direct-seeded and transplanted. They were seeded on the same date (June 4) and thinned June 12 or transplanted June 27 respectively. They were in separate completely randomized block design trials with 4 replications, 6 m single row plots 90 cm apart.

The hybrid cv. China Pride gave the highest total and marketable yield, and the lowest percentage seed stalks, both direct seeded and transplanted. The only complete failure was Tropical Delight cv. which bolted 100%.

Part 2. Winter Radish (Daikon)

Ten hybrid cvs. of Japanese winter radish (Raphanus sativus, Longipinnatus group) were grown in 6 m single row plots at 10 and 20 cm in row spacing, 90 cm between rows, in a quadruplicated completely randomized block design. Half of each plot was harvested at 61 and half at 77 days.

The long season cylindrical hybrid H.N. Cross gave the best yield and quality, especially at the later harvest date. Other excellent hybrids were the long type cvs. April Cross, Tokinashi, Summer Cross, Minowase, and Miyashiga (although the last 3 had some bolters). White Rate was satisfactory at the early date. The cvs. Toe Back, Japanese Nerima, and Sakuijima produced a high % of bolters and therefore low yield.

Part 3. Leeks (Allium ampeloprasum, Porrum group)

Fifteen cvs. of leeks were grown in a replicated variety trial, and three cvs. in a factorial multiple plant module trial in the "vegetable garden" area by the N.S.A.C. orchard. Unfortunately soil conditions reduced the growth and created variability. Multiple unit planting looked promising and will be repeated.

Conclusions: Part 1. Excellent chinese cabbage varieties are available for summer production. It is suggested that they could be promoted as a salad vegetable, since conventional use in Chinese style cooking offers limited markets.

Part 2. Winter radish are impressive producers, and newer hybrids are well adapted to our conditions. Market potential remains to be determined among non-orientals.

Part 3. Leeks require a long growing season and the best soil conditions, but are readily acceptable to local consumers as an onion substitute as well as for soups and boiled vegetables.

All of the above grow well under our climatic conditions and can be stored for several months. Potential for commercial production would seem promising.

TITLE: Clonal selection and propagation of the ostrich fern

LEADER: R.K. Prange

OBJECTIVE: To evaluate the performance of selected ostrich fern populations in a field nursery and propagate superior plants.

PROGRESS: 1986 harvest data on 91 populations of ostrich (fiddlehead) ferns, under cultivation since October 1981 in 1 x 2 m plots, revealed a drop from subsequent years in growth parameters such as average maximum height (cm) and oven-dry weight (g) because of the poor growing season. However, the 5 year trend is still toward increased overall growth for the 91 populations.

A picking versus non-picking experiment on the populations revealed that 46.5% of the picked halves had greater oven-dry weight (g) than the non-picked halves, indicating no negative effect to the plants through picking. However, using a smaller sample (15) which were picked in 1985 as well as 1986, revealed that 66.6% of these had greater oven-dry weights (g) for mature fronds from the picked half of the plot, suggesting a positive effect through picking in subsequent years.

In vitro propagation of 5 superior clones from the nursery was initiated in order to establish aseptic stock for rapid tissue culture multiplication of the ferns. Detached meristems from rhizomes were utilized for explant material following aseptic protocol. Callus growth was successful using an ostrich fern medium containing 0.5 strength Murashige and Skoog salts as proposed by Dykeman and Cumming (Can. J. Pl. Sci. 65: 1025-1032). A plantlet development medium is presently being used in order to establish root and shoot development from the callus material.

TITLE: Nutrition and Management of Lowbush Blueberries

LEADER: Leonard J. Eaton

OBJECTIVES: 1. To assess movement and storage of nitrogen in lowbush blueberries, using ^{15}N labelled fertilizer.
2. To evaluate long term effects of herbicides and fertilizers on lowbush blueberry yields.

PROGRESS:

1. Samples taken in May were very useful for evaluating movement and storage of nitrogen. Most of the fertilizer nitrogen applied in May 1985 remained within the system as organic nitrogen in plants, litter and soil. This suggests that the blueberry system conserves nitrogen.

One third to one half of the nitrogen present in the leaves during August was removed to stems, roots and rhizomes prior to leaf drop during autumn. The remaining nitrogen went into litter.

Plants took up labelled nitrogen from $\text{NH}_4^{15}\text{NO}_3$, suggesting that blueberries are able to take up nitrate under field conditions. Some nitrogen losses via leaching of nitrate occurred when ammonium nitrate was applied.

2. Yields were obtained during the eighth year of the long term nutrition project. Herbicide alone or herbicide + fertilizer resulted in significantly greater yields than did controls. The yields from plots fertilized with ammonium nitrate were similar to those from plots fertilized with an NPK fertilizer (1:1:1 ratio).

Project 86-27

TITLE: Evaluation of Hydrochloric Acid-Treated Direct Cut Silage for Dairy Cattle

LEADER: A. H. Fredeen

OBJECTIVES: To examine feasibility of preserving direct-cut forages using hydrochloric acid. To determine feeding value of silages preserved by application of hydrochloric acid for lactating dairy cattle. To examine effect of hydrochloric acid-preserved forages on blood mineral profiles of dry and lactating dairy cows.

PROGRESS:

Milk yield and composition and feed and nutrient intake were measured using a 3 x 3 latin square and 3 Holstein cows in mid-lactation. Concentrate was fed according to milk yield (1:3 ratio) and forage was fed ad libitum. Forage treatments consisted of field-dried hay (72 h in swath), wilted silage (20 h in swath) and direct-cut forage treated with hydrochloric acid (4 l 38% HCl diluted 1:1 with water per tonne). Forages were harvested from alternating swaths in a mixed alfalfa-timothy stand. Ensiled forages were chopped and stacked in 3m high rows. Acid solution was sprayed by hand onto the direct-cut forage and both piles were covered with plastic and weighed down with tires.

The latin square design was disrupted when one cow was replaced and the wilted silage spoiled after period 2. Consequently statistics were not significance-tested. The concentrate contained 18% CP, 0.5% Ca and 0.75% P. Hay, wilted and acidified forages contained: 89, 35 and 20% DM; 15.2, 17.8 and 19.0% CP, 39.6, 37.9 and 37.3% ADF; 0.9, 1.3 and 1.4% calcium and 0.42, 0.44 and 0.49% phosphorus respectively (all analysis but DM on dry matter basis). pH of wilted and acidified silages averaged 5.4 and 3.7 respectively, and wilted silage was spoiled before the trial was completed.

Forage intake was 12.0, 9.6 and 6.6 kg/d, and concentrate intake was 5.0, 5.7 and 7.2 for hay, wilted silage and acidified silage respectively (dry matter basis).

Daily milk yield (kg), fat (%) and protein (%) were: 13.3, 3.78 and 3.33; 17.5, 3.73 and 3.30; 22.1, 3.83 and 3.32 for hay, wilted silage and acidified silage respectively.

Acidified direct-cut silage contained a greater nutrient concentration than wilted silage or hay because of reduced field losses. Storage losses were not examined in this trial but acidified silage was superior under conditions of this experiment. Intake of acidified silage was reduced but higher nutrient concentration counteracted this to some extent.

TITLE: Differential Susceptibility of Crop Cultivars to Herbicides

LEADER: L.R. Mapplebeck

OBJECTIVE: To develop an accurate technique which can be used to quickly and economically screen herbicide susceptibility in crop cultivars.

PROGRESS: Soybean Cultivars/Metribuzin Susceptibility Study - Four soybean cultivars were selected and a series of experiments were undertaken in order to develop a technique for screening soybean cultivars for their relative susceptibility to metribuzin. Two of the cultivars chosen were known to be metribuzin susceptible (Baron and Maple Amber) and the other two were known tolerant cultivars (KG20 and Maple Isle). A number of variables were examined including: concentration of metribuzin, age of plants, duration of exposure, dark adapted vs. non-dark adapted plants, excised leaves vs. non-excised leaves, and leaf surface - top vs. bottom). A satisfactory technique was developed and 20 cultivars and numbered selections of soybeans were initially screened. Chlorophyll fluorescence readings and soybean plant fresh weight reductions (as influenced by metribuzin) of the 20 cultivars and numbered selections examined were positively correlated (.85). Further verification of this technique is required. Seed of other cultivars have been obtained (Ace and Apache from W.G. Thompson and Sons Ltd. - Hyland Seeds, for example) and these will be screened. Modification of the technique is also required in order to "streamline" the screening process to assess 50 or more cultivars at a time.

Potato Cultivars/Metribuzin Susceptibility Study - A technique (similar to the soybean technique) was developed to screen potato cultivars to metribuzin. The susceptible cultivars Belleisle, Tobique, and White Rose and the tolerant cultivars Kennebec and Russet Burbank were used in the initial developmental work. Similar parameters as those examined in the soybean research were studied. The technique developed indicates susceptibility or tolerance one to two days following treatment; hence it is very fast. Preliminary work on other cultivars of potato looks promising. The next stage is to apply the technique in the screening of the fifty plus cultivars that we have in the Department of Plant Science.

Strawberry Cultivars/Terbacil Susceptibility Study - The development of a similar technique (as described above for soybeans and potatoes) for strawberry cultivars progressed well during 1986. Results of the first year of this study look promising.

Eleven cultivars are under study. Work on this crop will also continue in 1987.

- TITLE:** American Ginseng (Panax quinquefolium L.) Production in Nova Scotia
- LEADER:** H.-Y. Ju
- OBJECTIVE:**
1. To test feasibility of commercially cultivated American ginseng in Nova Scotia
 2. To test the effect of mepiquat chloride on growth of ginseng roots.

PROGRESS:

The new shade structure constructed at Plumdale in fall 1985 (4 units each with 3.6 x 3.6 m x 1.8 m high) was covered with wooden laths on May 21, 1986. The ginseng plants seeded in late October 1985 grew normally during the year without any fungal and pest damage.

Ginseng plants in the orchard: Due to severe disease infections, all crops (1, 2, 3 and 4th year roots) were harvested in fall 1986. Harvested roots were examined for quality and percent dry matter. In general, quality was poor due to lack of uniformity. The average dry weight of 1, 2, 3 and 4 year-old roots were 0.2, 1.9, 5.1 and 9.2 g respectively. Percent dry weight of 4-year-old roots was 32.7% which was highest. Percent dry weight decreased as the age of roots decreased.

Fumigation with Vorlex: Two beds in Plumdale and 4 beds in the orchard were fumigated with Vorlex using a portable hand fumigator prior to seeding.

Growth regulator trials: On July 8, 1986 ginseng seedlings were sprayed with mepiquat chloride using various concentrations (0, 10, 100, 1000 ppm) to determine their effect on the growth of ginseng roots. The experiment was designed as a randomized complete block with six replications. On October 25, 1986, roots were harvested to determine the fresh weight, dry weight and percent dry matter. There was no significant differences among the treatments.

A general guide of ginseng culture was summarized to hand out to people who request information on ginseng.

Project 86-45

TITLE: Digestibility Studies Using Atlantic Canada Grown Feedstuffs

LEADER: D. M. Anderson

OBJECTIVE: To determine the dry matter, gross energy and crude digestibilities by pigs fed crops grown in Nova Scotia and other Atlantic provinces.

PROGRESS:

The study was undertaken to determine the amount of digestible nutrients in feedstuffs grown or produced in Nova Scotia. Determination of levels of digestible energy and protein will enhance the utilization of typical and exotic feedstuffs available in Nova Scotia since more precise recommendations on the availability of nutrients from these feedstuffs can be made when digestibility coefficients are available.

Apparent digestibility coefficients were determined on Nova Scotia grown corn, wheat, soybeans and canola seed. Fish silage produced in Nova Scotia and crab meal from the region were also examined. These digestibility values were determined using pigs initially weighing 35 kg. Six pigs were fed diets consisting of graded levels of these feedstuffs in four, 6 x 6 latin square design experiments.

TABLE 1
Digestibility Coefficients and Digestible Nutrient Levels
of Atlantic Feedstuffs

<u>Feedstuff</u>	<u>Digestibility Coefficients (%)</u>			<u>Digestible Nutrients *</u>	
	<u>Dry Matter</u>	<u>Gross Energy</u>	<u>Crude Protein</u>	<u>Digestible Energy (Kcal/kg)</u>	<u>Digestible Protein (%)</u>
Corn	86.2	84.4	76.6	3297	7.7
Soybeans	79.6	75.8	90.8	***	31.8
Canola Seed	70.7	70.9	75.5	4692	17.0
Fish Silage	64.1	80.1	100	2769	58.2
Crab Meal	58.9	69.0	76.2	1319	29.0
Wheat	86.4	86.4	86.3	3560	14.4

* Digestible nutrient contents are reported on a dry matter basis.

** Digestible energy of soybean seeds not determined due to lack of sample.

The digestible energy content of crab meal (Table 1) is extremely low and the inclusion of crab meal will result in lower energy levels in diets unless supplementary fat is added. Digestible energy in corn is low in relation to the wheat examined. Digestibility coefficients for these feedstuffs can be applied to analysed values of the feedstuffs to better estimate the use of the nutrients by pigs.

TITLE: Turfgrass Evaluation and Management

LEADER: R.W. Daniels

OBJECTIVE: To determine optimum seeding rates for perennial ryegrass cvs., at various seeding dates.

PROGRESS: Perennial ryegrass cultivars vary in seed size which results in differential seed numbers per unit mass. Recommendation for seeding are based on an assumed range of seeds per unit. For perennial ryegrasses, published reports range from 220,000 seeds per lb. to 300,000 seeds per lb. This in itself would result in a 25% error in actual number of seeds planted under traditional planting rate criteria.

Results of counting the actual number of seeds per unit of perennial ryegrass indicated that the variation among some cultivars was close to 100%. Variation in seed size between cultivars and within seed lots of a given cultivar result in considerable difference in seed number per unit.

Once a seeding rate is established, the subsequent plant population is determined by such factors as the growing environment and the quality of the seeds which are planted. Various sized seed of selected cultivars (Loretta, a relatively large seed size and Pennant, a relatively small seed size perennial ryegrass) were laboratory tested for germination. Their emergence was measured by planting these seeds in a greenhouse environment. Emergence was as predicted by laboratory germination. These various sized seeds were also field planted on May 31, July 15th and August 30th to simulate spring, summer and fall plantings. Maximum emergence of seedlings from all sizes of seed was obtained from the August 30th seeding. This was obtained in the fewest number of days from seeding of all planting dates. The July 15th planting had the earliest seedling emergence but the fewest number of seedlings. Results of the May 31st planting were between those of the other two plantings.

Research on this subject is continuing but results to date indicate that time of year and seed size must be considered when selecting a particular seeding rate.

Project 86-51

TITLE: Computerized Environmental Control and Flock Management System

LEADER: D. C. Crober

OBJECTIVE: Development of a commercial prototype for use in the chicken industry.

PROGRESS:

The current phase of the project, which is concerned with development and testing of a commercial prototype for use in a chicken layer facility, has progressed slowly because of lack of funds. All hardware and software requirements have been defined, and much of the software has been prepared. Specialized hardware design is currently underway.

A Business Plan to commercialize the results of this project is being prepared by a private firm organized for this purpose. Actual commercialization will depend on the efficacy of the system and the ability to raise the necessary funds.

TITLE: Quackgrass Biotypes

LEADER: M. G. Sampson

OBJECTIVE: To present information on the degrees of variation reported in quackgrass and discuss this in relation to the success of this plant as a weed and in escaping control attempts.

PROGRESS:

Quackgrass is a highly variable species due to it being a self-sterile species that is rarely inbred in nature. There is a great degree of heterozygosity present within the species which has resulted in the description of a large number of varieties, forms and "biotypes". The ability of quackgrass to reproduce vegetatively ensures that the variation expressed in these forms can persist in nature, often over large areas. Both morphological and physiological variation has been documented. Characters for which variation between clones has been reported include:

- a. Morphological characteristics such as stem elongation, rhizome morphology, shoot production, growth habit, leaf morphology, color, degree of hairiness, size of various plant organs, spikelet number, spikelet morphology.
- b. Physiological characteristics such as seasonal pattern of dry weight allocation, rate of distance of growth of rhizomes, time of emergence of spike, seed production, rhizome bud production, amounts of carbohydrate reserves, disease resistance, quantity of allelopathic chemicals produced, herbicide response, translocation and partitioning of the herbicide glyphosate in the rhizome. Variation between clones has also been reported for invasion abilities and depth of penetration of rhizomes. Further research is needed to determine the extent of this variation, how widespread it is in the environment and how easy this variability is maintained within the field. As quackgrass is a cross-fertilized species, the total number of biotypes can be immense. Additional research efforts should be directed at determining the effect of this variation on the colonizing ability and competitive of different quackgrass clones and the mechanisms behind the differential response to various control measures, including herbicides.

Title: Winter Wheat and Barley Diseases

Leader: A. B. Gray

- Objective:**
1. To identify races of Erysiphe graminis f. sp. tritici present in Nova Scotia.
 2. To evaluate the effect of the fungicide Propiconazole (Tilt) on seed-borne inoculum in barley inoculated with various concentrations of Pyrenophora teres.

Progress:

1. Races of E. graminis f. sp. tritici present in Nova Scotia were not virulent on wheat carrying the following genes:

Pm 1, Pm 3a, Pm 3b, Pm 7, Pm 8.
2. Optimum barley seed infestation occurred when inoculum contained 1000 P. teres conidia per milliliter; concentrations above 1000 conidia per milliliter did not significantly increase seed infestation. Propiconazole applied immediately previous to inoculation had no significant effect on the occurrence of seed-borne P. teres.

Project 86-66

TITLE: Determination of Gonadotropic Hormones by
Radioimmunoassay

LEADER: M. L. Connor

OBJECTIVE: To establish a radioimmunoassay for the determination of follicle-stimulating hormone and lutenizing hormone. To validate the assay so that it can be used for the determination of these hormones in bovine, ovine and porcine species.

PROGRESS:

Procedures for iodination and purification of labelled gonadotrophin were conducted. The radioimmunoassay for LH was set up according to established procedures. Seven assays were run using varying conditions in an effort to optimize binding of tracer and antibody. This series did not produce expected or satisfactory results.

Several assays were run using antiserum from a different source and new reagents. In all cases the results were not satisfactory and could not be used for analysis of serum LH.

Project 86-67

TITLE: Corticosterone Levels and Layer Performance

LEADER: A. R. Robinson

OBJECTIVES: To develop a reliable high pressure liquid chromatography procedure for the determination of corticosterone in blood samples of laying poultry stock. To determine the corticosterone concentration in blood samples collected by D. C. Crober in a project related to strain and housing effects on production of layers. To determine if a correlation exists between blood corticosterone concentrations, management variations and performance as well as genotype of laying stock.

PROGRESS:

A high pressure liquid chromatography procedure (HPLC) for the determination of corticosterone in avian plasma was developed. The sensitivity of the procedure was found to be 4.0 ng using a RP C₁₈ μ bond pak column. The most satisfactory mobile phase was found to be methanol:water (65/35 v/v) with a detector wavelength of 254 nm.

The retention time for corticosterone was 13.8 - 14.1 min which allowed complete separation from interfering compounds. The identification of the corticosterone peak was accomplished by using deoxycorticosterone as an internal standard.

The extraction of corticosterone from plasma samples involved extracting a one ml plasma sample with 5.0 ml isooctane which was discarded. The plasma sample was then extracted with 5 ml benzene which quantitatively removed the corticosterone. The benzene was evaporated and the residue picked up in 200 μ l methanol:water (65/35 v/v). One hundred μ l of this solution was injected into the HPLC.

The blood plasma levels of corticosterone were found to range from 1.3 - 18.5 mg/ml (verified by analysis of duplicate samples by radioimmunoassay). Since a large number of samples contained corticosterone levels below the sensitivity of the method (4 ng/ml), the high pressure procedure was deemed unreliable for the determination of corticosterone in avian plasma. Two series of blood samples have been taken and are currently frozen pending analysis by radioimmunoassay which does have the required sensitivity.

TITLE: Effect of temperature on predatory mites on apple

LEADER: Jean-Pierre R. Le Blanc, Ph.D., P.Ag.

OBJECTIVES:

To study the effect of temperature on the predatory mite, Typhlodromus pyri Scheuten (Acarina: Phytoseiidae), development rates and its density on apple cultivars in Nova Scotia. In Nova Scotia orchards the bionomics and life table data for T. pyri are a prerequisite for the implementation of IPM programmes. Therefore the objectives of this cooperative project with Kentville Research Station are to generate field and laboratory derived data on the effect of temperature on development rates, fecundity and predation of T. pyri.

PROGRESS:

Beginning in mid-May, numerous orchards in the Kentville/Wolfville area were sampled in search of over-wintered T. pyri females. Medium to heavy populations were found in four different orchards. Individuals collected from these orchards were transferred to freshly potted apple rootstocks in the greenhouse. P. ulmi was provided as a food source for the predators. A greenhouse population of P. ulmi was also established on predator free rootstocks for use as a food source in future T. pyri rearing trials. Greenhouse predator and prey populations received periodic additions of field collected individuals to ensure strong colonies.

Arenas designed for mass rearing were assembled and stocked with T. pyri. The primary food source of these predators was P. ulmi obtained from the greenhouse, although pollen collected from wild lupine (Lupinus perennis) was offered as a supplement. T. pyri individuals were observed to feed on both food sources. Video tape of the various life stages of T. pyri as well as feeding and mating activities was obtained from observations of the mass rearing arenas.

Trials of rearing individuals at different temperature regimes were initiated in eight different growth chambers. Eggs produced in the mass rearing arenas were used to stock individual boxes. A high mortality rate among individuals led to a changeover of this method to the use of gelatin capsules as a substrate (cage) for rearing trials. To date, gelatin capsules have proven to be a satisfactory environment. This way the necessary data for the completion of the programme will be obtained by the end of 1987. Data analyses and report writing are anticipated to be ready during the spring of 1988.

TITLE: Test tube pollination of cultivated potatoes.

LEADER: Dr. A. R. Olson

OBJECTIVE:

The development and refinement of reliable techniques leading to in vitro fertilization of potato ovules continues to be a high priority. The goal is to provide plant breeders with methods to circumvent certain breeding barriers in order to develop and transfer new sources of germplasm.

PROGRESS:

During the summer of 1986, work continued on the development of the two techniques which may lead to in vitro fertilization: placental pollination and ovarian-dish pollination. A number of technical problems exist which must first be overcome in order to facilitate the "normal" penetration of potato ovules by pollen tubes.

Problem 1. Cultivar fertility - A number of commercial and breeding stock genotypes exhibit a high degree of female and male sterility.

Proposed solution: Use a diploid clone known for its high degree selfcompatibility and seed set as the experimental organisms.

Problem 2. Water adhesion to ovular surface causing pollen tube bursting.

Proposed solutions: Use miracloth to separate the explant from the medium and draw off the excess water and/or "blot" the explants with sterile filter paper prior to pollination.

Problem 3. Pollen germination % in vitro is considerably lower than in vivo.

Proposed solution: Treat the exposed placentae and attached ovules with Brewbaker and Kwack's Calcium/Sucrose Solution to promote germination and tube growth in vitro.

The proposed solutions to each of these problems have shown considerable promise. Further adjustments of these solutions will be incorporated into a single, pollination procedure with a greater chance of achieving ovule penetration. The next major task is to determine whether or not double fertilization will take place as a result of increased pollen tube activity in culture. Experiments concerning this question are currently underway.

Project 86-70

TITLE: Germplasm Preservation by Freeze-Drying Potato and White Clover

LEADER: J. Nowak, K. MacLeod, N. MacLean, S. Hosking

OBJECTIVE: To study a potential application of freeze-drying for long term germplasm preservation.

PROGRESS:

In vitro techniques have been investigated for germplasm preservation of clonally propagated material. Unfortunately, most of the methods to date have proved unsatisfactory. Freeze-drying of in vitro plant material has been suggested as a means of overcoming existing limitations. Potato and white clover plants were chosen for this study because they are regenerative and can be easily propagated.

In vitro cultures of six potato cultivars, six wild Solanum species and selected clones of white clover were initiated and maintained on MS-based hormone-free media. Protocols for hardening of plantlets, callus and suspension cultures, prior to freeze-drying are currently being developed and evaluated. It is hoped that this work will lead to the optimization of pre-treatment techniques required for successful freeze-drying of plant material.

Project 86-73

TITLE: Effects of fertilizers and soil properties on asparagus yield and nutrition

LEADER: P. R. Warman

OBJECTIVES: To determine asparagus response to different rates and sources of fertilizers. To compare the yield of spears and the growth and elemental composition of asparagus ferns grown in 3 soils of contrasting chemical and physical properties.

PROGRESS:

Experiments were initiated in 1985 at 3 locations in Nova Scotia (Lismore, Beaver Brook and Princeport). Each site differed in soil chemical and physical properties. Approximately 1000 plants were transplanted in May 1985 at the 3 sites, 12 plants per plot. The plants were fertilized and limed the first year and shoot counts were taken in September.

At Lismore and Princeport, experimental plots compared asparagus intercropped (between the rows) with 5 or 6 species of legume ground covers. All plants received the fertilizer and lime rates recommended from the soil test reports. 1986 yields corroborated the results of the September, 1985 shoot counts, that is, yields were substantially reduced relative to the controls. Therefore, it was decided to incorporate all of the intercrops at these two sites in June, 1986, except one white dutch clover treatment at each site. The plants then received the recommended rate of fertilizer.

Different rates and sources of fertilizers were compared at Lismore and Beaver Brook. Fertility amendments included the recommended soil test rate of NPK, 1/2 the P_2O_5 rate, 2 rates of Mg, 1 or 2 rates of B (depending on the site), beef manure, and composted beef manure. All inorganic treatments included N and K_2O levels established through soil test recommendations; manure rates were based on the total N content of manure and the level of N recommended. Spears were harvested at the sites every 2nd or 3rd day from May 17 to 26. (Frost killed the first 3 potential harvests.) Yields were tabulated and statistically analysed. The LSD test for treatment differences showed that the high rate of Mg addition produced significantly greater yields than the 1/2 P and NPK rate at the Lismore site; the lower rate of Mg produced significantly more spears than the 1/2, NPK, beef manure and lower rate of B fertilized plots at the Beaver Brook site. Based only on this establishment year, therefore, it appears that Mg additions do have an important impact on asparagus production.

Amendments were applied and incorporated alongside the plants within 10 days following the last harvest. Plots were weeded throughout the summer, soil and tissue samples were collected in

July, and shoot counts were taken in September when new growth had ceased. The soil samples have been extracted and the tissue has been digested and analysed for 11 essential plant nutrients. The statistical analysis of the results is still underway.

TITLE: Growth Regulator Studies on Lowbush Blueberry

LEADER: H.-Y. Ju

OBJECTIVE: 1. To study the effect of gibberellic acid on growth and yield of lowbush blueberry clones.

2. To study the growth and yield in two and three year cycle systems for lowbush blueberry production.

PROGRESS: Gibberellic acid was applied as a foliar spray to fruiting year plants (NB3 clones) grown in greenhouse during full bloom. A randomized complete block design was used with five application rates (0, 1, 10, 100 and 1000 ppm) and four replications. No significant differences among treatments were found for length of side shoots or side shoot number; however, fruit set was significantly increased with higher gibberellic acid concentrations.

A study of growth and yield of two and three year cycle systems in lowbush blueberry production has been conducted at the N.S.A.C. using a plot owned by Mr. David Dickinson, Parrsboro and another plot located at the N.S. Blueberry Research Institute, Debert, Nova Scotia.

From the quadrant samples collected at the Dickinson's farm and at Debert, the number of plants in the second fruiting year crop was lower than in the first fruiting year crop. However the yield was higher in the second fruiting year crop than in the first fruiting year crop.

There were 100 samples collected from each area. Total shoot length in the second fruiting year crop was much higher than in the first fruiting year crop. This was due to an increased number of side branches produced from the main stem during the second and third years of growth. Higher yields were found in the second fruiting year crops from both quadrant and 100 sample collections. New shoot growth was more limited in the three year cycle than the two year cycle. This may have been caused by the suppression of dormant rhizome buds by fruit and by the established shoots including the new side branches.

No conclusion can be made from this experiment due to the limited sample collections. Future work must be done over a period of several years to assess the effects of production cycles on plant growth and yield.

Project 86-77

TITLE: Improving Cage Design for Laying Hens - Stage 2
LEADER: T. Tennessen
OBJECTIVE: To investigate the behaviour of hens kept in colony cages of 40, and to compare their egg production to that of hens in conventional cages.

PROGRESS:

One hundred twenty white Leghorn hens were distributed to three colony cages of 40 hens each. Another 120 hens were housed in single cages. Each colony cage is a 3-tiered enclosure with feeders on the bottom layer, drinkers in the middle, and 6 next-boxes and perches on top. All 240 birds were kept on a 16L:8D light regimen. But in the colony cage room, an artificial "dawn" and "dusk" were created by having the lights turn on and off gradually over a 30 minute period.

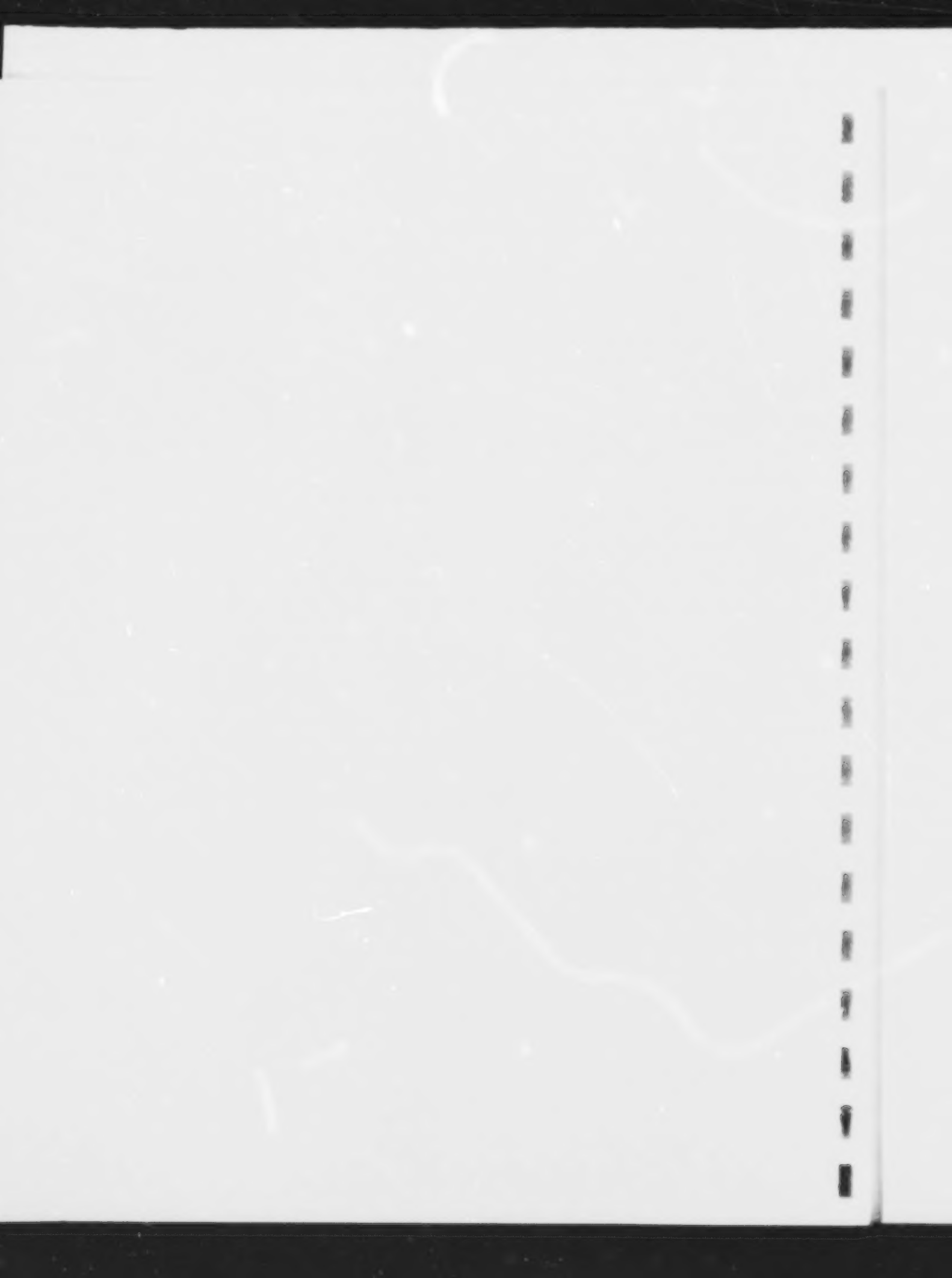
During the dusk period, birds tended to move to the upper layer and take position on perches and in next-boxes.

Table 1
Egg Production Summary for Stage 1 and 2

	<u>Stage 1</u>	<u>Stage 2</u>	<u>Single Cages</u>
Colony population (hens)	35	40	1
'Hen-day' production (eggs)	.846	.841	.865
% eggs laid in nest boxes	85.0	89.7	

FUTURE PLANS:

The potential of "dawn and dusk light control" to manage the behaviour of hens in colony cages will be studied.



Project 86-80

TITLE: Effect of Dietary Calcium Source and Amount On Blood Mineral Profile and Incidence of Parturient Paresis

LEADER: A. H. Fredeen

OBJECTIVE: To design a practical diet for dry cows which would prevent milk fever. To examine effects of diet calcium level and source on blood mineral profile and incidence of milk fever in dairy cattle in a herd with historically high incidence of milk fever.

PROGRESS:

Fifty-three dairy cows were used to test effects of prepartum dietary fixed ion balance and calcium content on blood mineral profile and incidence of milk fever. Three dietary treatments: high calcium (Ca) and phosphorus (P) from basic sources (Catex), high Ca and P from acidic sources (Anex), and low Ca and P (Dry) were compared. Cows were randomly assigned to treatments except heifers were generally not assigned to Dry. Blood samples were taken daily by venipuncture (tail vein) at 1300 hours from 7 days prepartum to 7 days postpartum.

Catex and Anex contained 19.5% crude protein (CP) and 0.86% Ca and 0.42% P, and 0.78% Ca and 0.42 P respectively. Ratio of Ca:P was approximately 2.0. Dry contained 13.2% CP with 0.38% Ca and 0.55% P in a ratio of 0:70. Balance of fixed cations to fixed anions, milliequivalents (sodium + potassium - chloride) per 100 g diet dry matter, were +28.9, -4.2, and +15.4 for Catex, Anex, and Dry respectively (as fed). Consumption of alfalfa-timothy hay and corn silage was not monitored and was assumed equal for all cows. Crude protein (%) and Ca:P ratios were 10.0, 2.9 and 2.9, 1.3 for hay and corn silage respectively. Dietary treatments were fed 2 weeks prior to parturition starting at 1 kg per day and increased at a rate of 1 kg every 2 days, reaching a maximum daily level of 5 kg. At calving cows receiving Dry were switched to Catex and diets were increased at the rate of 1 kg per day until the end of the trial.

No clinical milk fever was observed. At calving, plasma Ca, P and Magnesium (Mg) (ppm) were 88.4 ± 5.6 , 82.4 ± 5.5 , 26.5 ± 2.5 , 91.6 ± 5.6 , 81.9 ± 6.0 , 24.7 ± 2.0 , 80.0 ± 6.3 , 80.3 ± 9.8 , 32.9 ± 9.3 for Catex, Anex and Dry respectively. Plasma Ca was significantly higher in cows fed Catex compared to Dry ($P \leq 0.05$). For all treatments plasma Ca was significantly reduced at calving (day 0 and day 1), however, ANEX was depressed least. Parity significantly affected plasma Ca ($P \leq 0.05$). Plasma P was significantly lower at calving ($P \leq 0.05$). Parity had a significant effect on P and a diet-parity interaction was observed ($P \leq 0.05$). There was a significant effect of parity and day relative to calving on plasma Mg ($P \leq 0.05$). A diet-parity interaction was observed with plasma Mg ($P \leq 0.05$). Milk production in subsequent lactation was significantly affected by diet ($P \leq 0.05$), though effect of parity was confounded with diet.

TITLE: Price Forecasting and Hedging by Maritime Feed-Grain Industry

LEADER: K.G. Grant

OBJECTIVE: To determine usefulness of Winnipeg Commodity Exchange futures price quotations for forecasting and hedging in the Maritimes.

PROGRESS:

The research effort has been focussed on the benefits and costs of hedging the grain pooled by Nova Scotian farmers for sale through the Nova Scotia Grain Marketing Board.

This research is an application of an analytical framework for the study of hedging published by Louis Ederington in 1979. The case analyzed is the hedging of barley, but the methodology is applicable to other grains as well. The Board is modelled as the manager of a portfolio consisting of barley in storage and hedges placed in the barley futures contracts traded on the Winnipeg Commodity Exchange.

A routine hedging strategy has been developed in which lots of barley are hedged in that contract at least two month's from maturation which is closest to maturation. The hedging ratio chosen for each lot of barley is the one which minimizes risk, measured as the variance of returns.

The current policy of not hedging and the strategy of risk-minimizing hedging are simulated for the 1981-86 crop years. Hedging results in substantial reductions in the variability of returns. Moreover, there is a net return on the futures market position over the five years. Therefore, on the basis of risk and return, hedging proves unambiguously superior to the policy of not hedging.

Currently, this research continues with the alteration of the routine hedging strategy in order to reduce the transactions costs incurred due to frequent switching of the hedge. In the future, the methodology may be applied to other grains and selective hedging strategies may be developed.

Project 86-83

TITLE: Strain differences and prediction of carcass fat in broiler chickens.

LEADER: D. L. Patterson

OBJECTIVE: 1) To determine the differences in growth rate and carcass fat content of a commercial broiler strain versus an unselected population.
2) To determine the value of plasma very low density lipoprotein levels in predicting carcass fat in the two strains at various ages.

PROGRESS:

Commercial strains of broiler chickens have been selected for increased growth rate, but accompanying this growth has been an increase in fatness of the carcass. As consumers become more aware of the nutritional quality of foods the demand for lean meats increases. To effectively select for a lower carcass fat content a measurement is needed which can be taken on the live bird to predict fatness. Blood plasma very low density lipoprotein (VLDL) has been investigated for this purpose.

Two groups of chickens, a commercial strain and a purebred White Rock stock, were raised under typical commercial broiler management. Twenty males and twenty females of each strain were slaughtered at each of four intervals from four to seven weeks of age. Blood was collected from each bird immediately prior to slaughter, and various carcass measurements were made.

At all ages, White Rock birds were less than half the live weight of the commercial strain (717g versus 1883g for males at seven weeks of age), demonstrating the selection progress which has been achieved. The deposition of the abdominal fat pad appears to be related to the stage of the growth curve each stock is at when slaughtered. Abdominal fat pad weight, as a percent of live weight at seven weeks was 2.8% for males and 3.3% for females of the commercial strain versus 1.9% for White Rocks. The commercial strain carcass contained from 34 to 97g of fat in the abdominal fat pad alone.

Plasma VLDL measurements indicated that this value is not a reliable indication of the abdominal fat pad weight of the bird, on an individual basis, although it may have value in separating birds into two or three groups. Chemical analyses of the carcasses are being carried out, to determine percent carcass moisture and fat. Once this is complete, the value of using plasma VLDL to predict total carcass fatness will be determined.



Project 86-84

TITLE: Wet Versus Dry Feeds for Growth, Lactation and Reproduction in Foxes

LEADER: D. M. Anderson

OBJECTIVE: The project was initiated to compare commercial dry and wet fox feeds on the basis of growth performance and pelt quality in weaned foxes (10 weeks of age to pelting) and reproductive performance of virgin vixens and mature breeding females. Only the growth comparisons were completed during the 1986-87 budget year.

PROGRESS:

Comparison of Wet Versus Dry Diets for Growing Foxes

An experiment was set up in 1986 to compare the growth rates of foxes fed wet or dry pelleted diets. In previous experiments different feedstuffs could be considered a factor that result in varying growth rates. In this experiment a dry diet was formulated using dry feedstuffs equivalent to the locally available wet form. For example, where poultry waste (offal) was used in a wet diet, dried poultry by-product was used in the dry diet; meat meal was used in place of beef by-product; fish meal was used in place of fish and freeze dried egg used in place of cooked eggs. The fortified cereal portion of the diets were similar in composition. In this way diets made of similar feed ingredients were compared on a wet or dry basis. Those diets were also compared to a commercial dry diet as well as a wet diet containing 20% fish scraps (% of dry matter). The feed ingredients were fed to 100 fox puppies from approximately 10 weeks to 23 weeks of age in grower diets and from 23 weeks to pelting in furring diets. The commercial pelleted diet was Purina Fox Developer Checkers which was fed for the entire growing and furring phases.

At present only growth rates are available for these foxes (table 2). The commercial dry diet and the wet diet with no fish resulted in gains of 5.86 and 5.84 kg respectively. The N. S. A. C. dry diet and the wet diet with fish produced gains of 5.34 and 5.36 kg respectively. Growth rates on all treatments were approximately 800 to 1000 grams greater than the year previous (table 1). The results indicate that satisfactory growth is obtained on wet or dry diets.

Table 1. Growth Rates of Foxes Fed Wet or Dry Diets (kg)

	Commercial Dry Diet	NSAC Dry Diet	Wet Diet No Fish	Wet Diet Fish
Growth Rates (10-23 weeks)	4.357	3.530	4.043	4.145
Growth Rate (23 weeks-pelting)	1.499	1.807	1.794	1.216
TOTAL	5.856	5.337	5.837	5.361

Further computation of results will provide feed efficiencies, and pelt results for comparison. These will be available in the near future.

Project 86-86

TITLE: Strain and Housing Effects on Caged Layers

LEADER: D. C. Crober

OBJECTIVE: Examination of the interrelationship between genotype, housing system, stress and performance of caged laying stock.

PROGRESS:

This study involves the use of two successive flocks of White Leghorn layers provided by the Animal Research Centre, Ottawa. The first flock, which consisted of three experimental strains, was housed at three different cage sizes, each at two different stocking densities. Information on egg production, egg size and quality, and mortality was collected over a complete laying cycle. Blood corticosterone level, as a measure of physiological stress, was determined for a sample of birds in each strain/cage/density group at three stages during the production cycle.

The second flock, representing two experimental and one commercial Leghorn strain, is being housed over the same range of cage sizes and stocking densities as the first. Performance and stress is being monitored over a full production cycle, which is now underway. Appropriate statistical analyses will be carried out once all data on both flocks have been collected.

Project 87-75

TITLE: Direct, rapid assay for tritiated water (^3HOH) in soil samples.

LEADER: J. C. Miller

OBJECTIVE: The use of tritiated water (^3HOH) as a tracer is an important technique in studies of water movement and solute transport in soil. Modern liquid scintillation counters allow for rapid and convenient assays of tritium. However, the standard method of preparation of soil samples for radioassay of tritiated water involves the separation of water from soil by either centrifugation or distillation.

A substantial saving in time and labour can be achieved if the moist soil sample could be mixed directly with the scintillation cocktail for liquid scintillation counting (LSC) of tritium activity. It is the objective of this project to develop and test a system for counting and quench correction for ^3HOH -- soil -- scintillation cocktail mixtures.

PROGRESS:

Research undertaken during the summer of 1985 indicated the potential for this method, as well as pointing out the important limitations which had not been identified in the soil science literature.

The liquid scintillation cocktail formulation developed in our experiments were suitable for the purposes described in the objectives. It was determined that very careful control over either the amount of water or the amount of soil in the samples was required in order to use standard correction curves to convert the intensity of radiation detected by the LSC to actual intensity of radiation emitted by the sample.

The LS cocktail formulated was compared with one commercially available cocktail and found to be superior to the commercial cocktail for most of the range of conditions studied.

The preliminary results of the study were presented to the annual meetings of the A. I. C. in Charlottetown, in June 1985. Questions arising at the presentation and in subsequent correspondence indicated that there was interest in the method being developed.

Some recently developed commercial non-gelling LS cocktails with enhanced miscibility with water also show promise for use in this procedure. An essential component in this research would be to test the LS cocktail formulated by the applicants with the appropriate commercial formulations. This work was started in the

summer of 1986 and will comprise the major portion of the research effort undertaken in 1987.

TITLE: Evaluation of Kale (Brassica oleracea) Pasture for Beef Cows in Late Pregnancy.

LEADER: A. H. Fredeen

OBJECTIVE: To evaluate kale as a pasture crop for beef cows in late pregnancy.

PROGRESS:

Two groups of 7 pregnant cows were randomly chosen from the N. S. A. C. beef herd. Cows were 5 to 6 months pregnant at initiation of the experiment. Initial body weights (kg) and condition scores (out of 5) were: 566 and 3.2, and 591 and 3.6 for kale and control groups respectively.

The control group grazed grass pasture supplemented with hay, while the kale group grazed kale and grass pasture during the month of November. Both groups had free access to a trace-mineralized salt block containing iodine.

Body weights (600 kg) and condition cores (3.2) were similar in both groups after the experimental period. Blood samples taken by venipuncture (tail vein and carotid) revealed no significant effect on progesterone profile but packed cell volume (%) was significantly diminished in the kale group from 31.0 to 26.4. All cows calved.

More research is needed to determine the nature of the reduced packed cell volume in cows grazing kale, and whether there is an effect on cow performance.



TITLE: Use of Artificial Insemination in the Production of Hatching Eggs

LEADER: D. C. Crober

OBJECTIVE: To examine the feasibility of using artificial insemination with a commercial hatching egg supply flock.

PROGRESS:

This field trial was carried out in cooperation with the New Brunswick Department of Agriculture and a commercial hatchery operator in New Brunswick. It involved two comparisons, during successive years, of the fertility of artificially inseminated females of two ages with naturally mated females. Each comparison was of three months duration.

Differences in fertility of artificially inseminated first-cycle females and those mated naturally were not significant. The fertility of artificially inseminated second-cycle (force-molted) females was significantly lower than that of the first-cycle artificially inseminated birds. Twice-weekly insemination resulted in superior fertility as compared to once-weekly insemination. Dilution (2:1) of fresh semen with semen extender resulted in markedly reduced fertility as compared to undiluted semen.

TITLE: Use of Intermittent Lighting For Commercial Layers

LEADER: D. C. Crober

OBJECTIVE: Evaluation of the 'Biomittent' intermittent lighting program for commercial caged layers at two stocking densities.

PROGRESS:

This project involved a comparison of the 'Biomittent' lighting program with conventional lighting for commercial layers. A commercial White Leghorn strain was housed at two stocking densities (two and three per 10" cage). Performance data was collected over a complete laying cycle. The biomittent program, which consists of 15 minutes of light and 45 minutes of darkness per hour, over the entire day, was introduced to one-half the flock at 36 weeks of age. The remaining half continued to receive a single 16 hour period of light per day, as was introduced to the entire flock at 20 weeks of age.

Preliminary analysis of data revealed no difference in hen-housed production between the biomittent and control lighting treatments.

TITLE: Accelerated lamb production using light control

LEADER: W. G. Mathewson

OBJECTIVES: To compare the productivity of ewes of four crossbred genotypes under Traditional and light-controlled management.

PROGRESS: Over the 4-year period 1981-1985 a comparison was made of the productivity of two flocks, one managed traditionally with annual spring lambing and summer pasturing; the other housed year-round and managed more intensively using light-control to induce breeding at 8-month intervals, i.e. a "3 in 2" system. Each flock initially totalling 60 ewes comprised equal numbers of Finn x Cheviot, Suffolk x Cheviot, Hexham Leicester x Cheviot and "Western". All ewes were born in 1980. The light regime under which the Intensive flock was kept comprised alternating 4-month periods of 8 hours (short) daily light and 16 hours (long) light. Dorset rams kept under the same light conditions were introduced half-way through each short-light period for two cycles. Lambing took place in May, January and September and lambs were weaned when the youngest was 1 month old.

During the 4-year duration of the trial, the Traditional flock lambed 4 times; the Intensive flock 6 times. Over this period lambing rates in the two flocks (% ewes lambing) were 87% (Traditional) and 84% (Intensive). If the first year's data be excluded because of ewes' immaturity, these percentages become 93 and 90 respectively. Over the period of the trial, lambing percentages (marketable lambs produced per 100 ewes exposed) averaged 130 (Traditional) and 118 (Intensive) at each lambing. On an annual basis the latter figure becomes 177. Again, if the first year's data be similarly excluded the percentages on an annual basis become 157 and 210 respectively. Under Traditional management the ranking in terms of lambing percentage was F>S>W>L while under Intensive management the ranking was F>W>L>S. In both cases however the superiority of the Finn crosses was most marked at first (yearling) lambing. If first year data is excluded the Traditional ranking becomes S>W>F>L while the Intensive ranking is unchanged.

While the trial showed a clear advantage for the 3 in 2 system in terms of lamb production, the increased feed cost of maintaining the Intensive ewes in acceptable body condition outweighed the advantage in production. As a result while in the Traditional flock an animal return over feed cost of \$41 per ewe was generated, under Intensive management the corresponding figure was a loss of \$15.

TITLE: Free(r) Canada-United States Trade and Atlantic Canada's Agriculture

LEADER: K.G. Grant

OBJECTIVE: To determine potential effects of free(r) bilateral trade between Canada and the United States on Atlantic Canada's agricultural sector.

PROGRESS:

This policy research has been concentrated on the supply-managed commodities and the Atlantic Livestock Feed Initiative.

The value of production of supply-managed commodities is identified as being relatively more important in Atlantic Canada than it is in the rest of the country.

It is concluded that, although there is unlikely to be any substantial reduction in U.S. government intervention in its dairy sector in the short term, the U.S. negotiators may nonetheless press for improved access to the Canadian dairy market through lessening of the trade restrictions which currently protect Canadian producers from American competition. The U.S. feather industries are likely to press for increased access to the Canadian market. Moreover, the current restrictions on the interprovincial movement of supply-managed commodities may be brought into question by the trade negotiations. Each of these potential developments would have harmful effects on producers and their input suppliers in Atlantic Canada.

The basic criterion that must be met for the negotiation of a free(r) trade deal is the perception of net gains to each country. This does not preclude one sector being 'traded off' against another or one region being traded off against another. In this environment, producers in the supply-managed sector of Atlantic Canada's agriculture are well-advised to press the argument that free(r) trade is unambiguously beneficial from the national perspective if and only if the winners can and do compensate the losers and still regard themselves as winners.

The Atlantic Livestock Feed Initiative is identified as a policy which may ultimately have the effect of substantially increasing the regional production of livestock feeds if it causes changes which favour producers, manufacturers, and distributors in Atlantic Canada relative to those in the regions from which livestock feeds are imported.

The Initiative is being launched at a time of low prices for livestock feeds. As both Canada and the United States are net exporters, it is concluded that a bilateral trade agreement will not provide a direct solution to the problem of low prices. A far more likely avenue for solution of the problem of the price-depressing effects of policy-induced surpluses is the current round of multilateral trade negotiations under the GATT.



TITLE: Herbicide Screening in barley, soybean, corn, blueberries, and fallow

LEADER: M. G. Sampson

OBJECTIVE: To evaluate various herbicides for broadleaf and grass weed control in barley, soybeans, corn, blueberries and fallow.

PROGRESS:

1. Broadleaf Weed Control in Barley.

Seventeen herbicides or herbicide combinations were evaluated for broadleaf weed control in barley. MCPA (0.56 kg a.i./ha) and Buctril M™ (0.56 kg a.i./ha) were used as standard treatments. All products tested provided good weed control. The products DPX M6316, DPX R9675 and DPX L5300 provided very good weed control at the higher rates tested as had the tank mixes of Clopyralid and MCPA and/or bromoxynil. Clopyralid alone did not provide adequate control of wild radish nor did DPX M6316 at 0.015 kg a.i./ha.

2. Broadleaf Weed Control in Corn.

Twenty-four herbicide or herbicide combinations were evaluated for broadleaf weed control in corn. All products except for Clopyralid (0.2 kg a.i./ha), EF 689 (0.15 kg a.i./ha), Bromoxynil (0.28 kg a.i./ha), and BAS 48543H (1.0 and 1.25 kg a.i./ha) provided excellent control of broadleaf weeds in corn. The most promising products include FR 1330 (May and Baker), DPX M6316 (Dupont Canada Inc.), XRM 4896 and XRM 4813 (Dow Chemical Company) look very promising. The standard treatment (Metolachlor + Atrazine + Linuron) also provided excellent weed control.

3. Corn Tolerance and Annual Grass Control with Laddock + Poast.

Laddock™ and Poast™ (BASF Canada Inc.) at 1.2 + 0.064 and 1.6 + 0.064 kg a.i./ha were tested on three varieties of corn (Pride 111, Pioneer 3925, and Pioneer 3953) for varietal tolerance to Poast™. Laddock provided excellent control of broadleaf weeds. Annual grasses were controlled by Poast but rates were too low to control quackgrass. There were varietal differences in response to Poast. The earlier maturing variety (Pioneer 3953) appeared to be more susceptible while later maturing varieties were more tolerant.

4. Grass Weed Control in Soybeans.

Eighteen herbicides, alone and in combination with ammonium sulfate were tested in soybeans for control of quackgrass. The herbicide DPX Y6202-23 (Dupont Canada Inc.) provided the best control particularly at rates of 0.3 kg a.i./ha. The related compound, DPX Y6202-31, provided similar control and appeared to be twice as active. The level of control achieved with these compounds was superior to that achieved with the standard treatment (Sethoxydim + Assist + Ammonium sulfate - 0.5 kg a.i./ha + 24/ha + 44/ha). The addition of ammonium sulfate to lower rates of each of the herbicides provided as much control as the higher rates.

5. Broadleaf Weed Control in Soybean with AC263-499.(Cyanamid Canada Inc.).

AC263 499 is a broad spectrum herbicide being evaluated for pre-emergence weed control in soybeans. This herbicide provided excellent control of all weeds present except lambsquarters at rates ranging from 0.075-0.15 kg a.i./ha. The addition of Linuron or metribuzin improved the level of weed control achieved by controlling lambsquarters.

6. Broadleaf Weed Control in Soybean.

Thirteen herbicide treatments were evaluated for broadleaf weed control in soybeans. The predominant weed present was wild radish. The herbicide Fomesafen tank mixed with Bentazon provided excellent weed control. However, there was phytotoxicity on the soybeans. The herbicide DPX M6316 also provided good weed control at rates of 6 g/ha and above.

7. Bunchberry Control in Blueberry.

Four experiments involving 26 different herbicide treatments were conducted for bunchberry control in blueberry. All herbicides which provided bunchberry control were also phytotoxic to the blueberries. The herbicide with the least amount of damage was Sulfometuron methyl. Even though there was phytotoxicity during the first year of application, blueberry regrowth the second year was excellent and there was significant yield increases over the standard treatment of hexazinone at 2.5 kg a.i./ha.

8. Quackgrass in Fallow.

Twenty-one herbicide treatments were evaluated for quackgrass control in non-crop situations. The herbicide DPX Y6202-31 was the most effective herbicide giving as much as a twenty-fold decrease in quackgrass density at rates as low as 75 g a.i./ha. The herbicide HOE 39866 also gave excellent initial control of quackgrass but regrowth was extensive. The addition of ammonium sulfate significantly improved quackgrass control, particularly at low rates of the herbicides.

TITLE: The development of an integrated weed control program in barley for Agropyron repens (L.) Beauv. (Quackgrass) - A systems approach.

LEADER: M. G. Sampson

- OBJECTIVES:
1. To evaluate the various quackgrass control measures alone and in an integrated system.
 2. To study the population dynamics of quackgrass in the presence and absence of these control systems.
 3. To obtain information on yield-weed density relationships and obtain information on the economics of the various control options to be incorporated into a cost-benefit analysis.

PROGRESS:

A. Control systems and population dynamics of quackgrass:

Three experiments were conducted in 1986 to study the effect of various control systems on the population dynamics of quackgrass.

1. The first experiment established was a herbicide evaluation trial in which various chemicals, which have been reported to control quackgrass, were evaluated alone and in combination with ammonium sulfate for control of quackgrass. Biweekly recordings of weed density in permanent quadrats and percent control were recorded. Rhizome production was also recorded at the end of the season. There was quackgrass regrowth from all chemicals tested. However, the chemicals DPXY6202-23 (Dupont Canada Inc.) and DPXY6202-31 (Dupont Canada Inc.) provided the best control and gave significant reductions in both shoot and rhizome growth. This experiment will be repeated in 1987.
2. The second experiment involved an evaluation of various rates of glyphosate applied pre-harvest to control quackgrass in barley. Treatments included glyphosate applied one week prior to harvest at rates of 0.9 kg a.i./ha, 1.8 kg a.i./ha, 2.5 kg a.i./ha. Additional treatments of these rates in combination with 3.0 kg of ammonium sulfate were also applied. Biweekly densities of quackgrass were recorded to follow the population growth of quackgrass in barley. Because these treatments were applied late in the season, the effectiveness of the controls will not be known until spring. However, indications in the fall are that adequate control is being obtained at all rates. Percent germination of barley seed was not affected by the 0.9 kg and 1.8 kg treatments. There were, however, slight depressions in percent germination at higher rates. This experiment will be monitored in 1987. In addition, the experiment will be conducted at a second site.
3. The third experiment involved a study of the effects of combining tillage and herbicide applications on the control of quackgrass in barley planted following sod. Because notification of this grant was not received until late in the spring, this experiment could not be set up in the spring. Instead, it was established in September, 1986. A similar experiment will be set up in the spring of 1987. The experiment was established as a split-split plot experiment in a randomized complete block design. Main plots

consisted of timing of tillage (spring only, fall only, fall + spring). Subplots consisted of timing of glyphosate application (spring, pre-harvest, post-harvest). Sub-sub plots consisted of rates of glyphosate (0, 0.9, 2.25 kg a.i./ha). This experiment will be carried out over the next two seasons on the same site, as will the experiment to be established in the spring of 1987.

B. Weed Crop Competition:

A competition experiment involving barley and natural populations of quackgrass was established to determine the effect of quackgrass on the total plot yield and thousand kernel weight of barley. Correlation analysis and regression analysis will be performed on the data to determine the variations that exist in barley yield with varying populations of quackgrass. Quackgrass density will be considered as a covariable. As was expected, results indicated that there was a negative correlation between quackgrass density and yield. This experiment will be repeated in 1987. Again, due to the late notification of the award, an experiment involving differential populations of quackgrass could not be established. This experiment will be set up in the spring of 1987 and repeated in 1988.

C. Construction of data base:

Literature surveys are continuing to obtain as many references as possible on the growth, development and control of quackgrass in cereals. Copies of papers and reports dealing with quackgrass are being collected and kept for review to provide additional information to develop a control strategy for this weed.

This project was supported by an Agriculture Canada Operating Grant.

TITLE: Effects of Plant Growth Regulators on Growth of Lowbush Blueberry

LEADER: J.C. Lewis and H.-Y. Ju

OBJECTIVE: To study the effect of various growth retardants on the growth and yield of lowbush blueberry crop

PROGRESS: Various plant growth regulators were applied to lowbush blueberry as foliar spray or soil drench to determine any effects on growth and yield in a commercial field. NAA, 300 ppm; IBA, 1000 ppm; GA, 50 ppm; kinetin, 1.5 ppm and PPG-1721, 50 ppm, were applied as a foliar spray to sprouting year plants in a commercial field on June 14. Daminozide, 2500 ppm; chlormequat, 1500 ppm; ethephon, 500 ppm; mepiquat chloride, 100 ppm; and paclobutrazol, 1000 ppm, were sprayed on July 8. Each experiment was a randomized complete block design with four replications. In October, 40 plants per plot were harvested and total shoot length and flower bud numbers were determined. No significant differences were found in either experiment; however, paclobutrazol and ethephon treatments produced shorter plants and more flower buds per plant than other treatments including control plants. It seems that clonal variation seen in the field may be a factor contributing to the lack of consistency in the results.

The same PGR's as were used in the sprouting year experiments above, were used in this study to examine the effects of these compounds on fruiting year plants in commercial field. In the first experiment NAA, IBA, GA, kinetin and PPG-1721 were applied as a foliar spray June 14 in a randomized complete block design with four replications. On June 19, daminozide, chlormequat, ethephon, mepiquat chloride and paclobutrazol were sprayed in an identical design. Prior to spraying, 40 random plants/plot were tagged and measurements of plant height, number of side shoots and average length, number of flower buds, and numbers of flowers were made. In August, during berry harvest, the same plants were excised and numbers of berries, leaf biomass (dry weight), and total shoot growth were determined. In addition, berries were harvested within a 40 x 40 cm quadrat placed in the center of the 2 x 2 m plots. No significant differences among treatments were found for berry production per plant or for the 40 x 40 cm quadrats. Although data are incomplete for leaf biomass and net growth there do not appear to be noticeable differences among treatments.

Paclobutrazol was applied as a soil drench to sprouting year plants in a randomized complete block design with five application rates (0, 0.1, 0.5, 2.5, and 12.5 kg a.i./ha) and five replications. This experiment was initiated on July 17 at the Nova Scotia Blueberry Institute, Debert, N.S. and biweekly observations of plant growth and color were made over the course of the growing season. On November 5, 40 sprouts were randomly collected from each plot and measurements of total shoot length and flower bud numbers were determined later. Observations indicated that with increasing concentration, paclobutrazol produced progressively shorter and darker-green plants. Increasing paclobutrazol concentration did produce significantly (0.05 level) shorter plants but more importantly produced significantly greater flower bud numbers.

This project was supported by an Agriculture Canada Operating Grant.

TITLE: Puberty Induction and Ovulation Rate in Gilts

LEADER: M. L. Connor

OBJECTIVE: Phase 1 - To determine if a short prepuberal period of restricted feed intake will affect the age of puberty in gilts. To determine if there is a change in ovulation rate between the first and third estrus in gilts.

Phase 2 - To determine if ovulation rate at first through third estrus influence embryonic survival in gilts.

PROGRESS:

Done in cooperation with the Agriculture Canada experimental farm at Nappan, each phase of this project has used two replicates of 72 animals each. All gilts were exposed to a boar daily beginning at 150 days of age. Gilts were killed at 10 days after their first, second or third estrus and various parameters measured. Phase one results indicated that a brief period of feed restriction (0.5 kg/animal/day) from day 150-155 did not markedly affect the age of puberty. Mean age of puberty for phase one was 228 ± 37 days. Average ($\pm$ SD) uterine weight increased between first and second estrus (462.2 ± 143.5 g to 588.7 ± 201.0 g respectively) but changed little by the third estrus (592.7 ± 199.9). The average corpora lutea (CL) number was similar at each estrus (15.1 ± 4.2 , 14.3 ± 3.6 , 14.4 ± 4.3 at first, second and third estrus respectively). Counting number of corpus albigans was found to suggest a lower ovulation rate at first and second estrus than was demonstrated using CL number. This study indicates that lower ovulation rates at first or second estrus in gilts are not the cause of lower litter sizes. Results from the second phase of this trial will more closely investigate this relationship along with early embryonic survival.

This project was supported by Agriculture Canada Operating Grant.

TITLE: Effect of Rate of Feeding Concentrates on Forage and Nutrient Intakes and Performance of Dairy Cows in Mid-lactation.

LEADER: A. H. Fredeen

OBJECTIVE: To study the effects of three levels of concentrate on nutrient intake, milk yield and milk composition. The economics of feeding various levels of concentrate were also studied.

PROGRESS:

Six mature Holstein and three Ayrshire cows entering mid-lactation from the N. S. A. C. dairy herd were used to study the effects of three levels of concentrate on nutrient intake, milk yield and milk composition. The economics of feeding various levels of concentrate were also studied.

Cows were randomly assigned to three groups and groups were assigned to three rates of milk:concentrate ratios - 3:1, 3.5:1 and 4:1, in a 3 x 3 Latin square design, replicated 3 times. Rates were based on three different intake predictive formulae. The amount of concentrate fed was established on day (d) 1 and altered according to yield d7 and d14 of each 21d feeding trial period. Water was provided ad libitum. Forage and concentrate intakes, and milk yield were determined during d14 to 21. Feeds were analyzed for crude protein (CP), acid detergent fibre (ADF), calcium (Ca) and phosphorus (P) and digestible energy (DE) was estimated. Dry matter (DM) was determined by toluene distillation. Milk samples were analyzed for CP, fat and total solids.

Concentrate intake of cows fed 3:1, 3.5:1 and 4:1 was 7.17, 6.20 and 5.72 kg respectively while forage dry matter intake was 10.93 kg, 10.3 kg and 10.55 kg. All cows met their energy, calcium, phosphorus and protein requirements, however, significant differences ($P < 0.05$) were found in P and DE intakes.

Cows yielded 21.01 ± 4.82 , 21.47 ± 5.16 and 20.91 ± 1.84 kg milk/day with 3.91 ± 0.05 , 3.84 ± 0.07 and 4.00 ± 0.021 percent fat and 12.68 ± 0.35 , 12.61 ± 0.22 and 12.91 ± 0.42 percent total solids for treatments 3:1, 3.5:1 and 4:1 respectively. Protein percent for all three treatments was 3.30 ± 0.10 . Milk yield, fat percent and protein percent were not significantly different among treatments ($P > 0.05$).

Income over feed cost was \$9.45, \$9.99 and \$9.90 per day for cows fed a 3:1, 3.5:1 and 4:1 respectively.

In this experiment, feeding a milk:concentrate ratio of 4:1 maintained milk production and provided adequate nutrients to

meet the requirements of a dairy cow in mid lactation and was more economical than feeding a 3:1 ratio. Work is continuing to find an equation for calculation concentrate requirements of cows past peak yield that considers forage quality as well as milk yield.

This project was supported by Atlantic Institute of Biotechnology.

TITLE: Biological Control of Perennial Weeds in Nova Scotia

LEADER: M. G. Sampson

OBJECTIVE: To coordinate a biological control program in Nova Scotia

PROGRESS:

The following projects are ongoing:

1. Biological control of Senecio jacobaea L. (Tansy ragwort) in Nova Scotia. Two insects have been introduced into Nova Scotia for biological control of tansy ragwort. The cinnabar moth (Tyria jacobaea (L.)), established in 1964, has spread throughout all areas of the province where ragwort occurs and is still exerting significant downward pressure on ragwort populations. This moth is gradually adjusting its phenology so that larvae are now present throughout July and most of August. In 1986, populations of this insect remained low throughout most of the areas where it occurred. Therefore, levels of defoliation were not as severe as in previous years and more plants than usual flowered and set seed. This is most likely a reflection of the cool, moist conditions which were experienced throughout most of the summer. The weed continues to be a problem in pastures where the cinnabar moth has not been able to become established, most likely due to unfavorable environmental conditions. In addition, even though plants are severely defoliated, some plants are able to produce a second bloom and still produce seed. The ragwort flea beetle (Longitarsus jacobaeae Waterhouse), introduced in November 1984, has not been found to date in 1986. Attempts are continuing to locate the insect.
2. Biological control of Cirsium arvense (L.) Scop. - (Canada thistle) in Nova Scotia. The insects Urophora cardui (L.) and Ceutorhynchus litura (F.) were introduced into Nova Scotia in 1984. U. cardui has been established in several locations in the province. Insect numbers in 1986 were significantly lower than 1985, most likely due to the poor climatic conditions this summer. Adult insects reared in the greenhouse released in 1986 were more successful in establishing galls in new release sites. No appreciable damage has been attributed to this insect as of yet. No adults of C. litura were detected in 1986. Populations of Canada thistle in several locations were monitored in 1986 for damage caused by naturally occurring organisms. The mycoplasma, aster yellows, was much more common than in previous years. The rust Puccinia punctiformis was not as common in the spring as in 1985. However, in the late summer pycnia and primary infections were noted on a large number of plants. Cassida rubiginosa populations were very high, and severe defoliation was observed at several locations. These organisms, although causing damage, are not considered to cause significant reductions in populations of Canada thistle. However, at one biological control study site in Bridgetown, Annapolis County, Canada thistle has been reduced to very low levels (less than 50 plants in the 20 ha field). This has been attributed to insect damage combined with competition from other plants.
3. Biological control of Hypericum perforatum L. (St. John's wort) in Nova Scotia. The Chrysolina beetle (C. hyperici (Forester)) introduced in 1969, has increased and spread throughout most areas of Nova Scotia except for Cape Breton Island. A release of C. hyperici was made in Coxheath, Cape Breton County to establish the insect on the island of Cape Breton. St. John's wort is generally restricted to roadways and in abandoned, disturbed areas. However, it is becoming a problem in blueberry fields where insecticide sprays are most

likely interfering with the effect of the beetle on the weed. Insect populations were high early in the summer. There was a dramatic decline in populations in mid- to late summer. Only 10 adults were recorded on 1500 plants during the first week of August. This is most likely due to the poor weather conditions in the latter half of summer. The insect, Anaitis plagiata was released in New Glasgow, Pictou County in 1986. This site will be monitored for establishment of this insect.

4. Biological control of Sonchus arvensis L. (Perennial sow thistle) in Nova Scotia. The gall midge Cystiphora sonchi was released in Great Village and west North River, Colchester County and the insect successfully established at both locations at least two generations were completed at each site. These sites will be monitored for winter survival in 1987. The seed head fly Tephritis dilacerata was released in 1984. No adult flies were detected in 1986, nor were any deformed flower buds found. Therefore, it is doubtful if the insect survived its second winter. The site, however, will continue to be monitored for establishment of this insect.

5. Biological control of Cirsium vulgare (Savi) Tenore (bull thistle). Urophora stylata was released on bull thistle in 1985 in Eastville, Colchester County. The insect successfully overwintered and galled flowers were found in 1986. Fifty plants were monitored for the presence of the insect. A total of 44 plants had insect galls. Mean flower number was 22.5 while mean number of flowers with insect galls was 3.7. No galls were dissected in 1986, due to the first year of establishment of the insect. There was a high density of first year rosettes present in the pasture which should provide sufficient host plants for next year. The site will continue to be monitored.

6. Isolation of pathogens from various weeds in Nova Scotia. Pathogens have been isolated from a total of twenty weeds and are currently being investigated for their potential as weed control organisms. Selected pathogens on quackgrass, wild buckwheat, hemp nettle, colts foot, Canada thistle and field horsetail are currently being studied for growth and reproduction on different media and optimum spore concentration for optimum damage.

This project was supported by the Canada-Nova Scotia Agri-Food Development Agreement.

TITLE: In Vitro Selection of Cold Stress Tolerant Alfalfa

LEADERS: J.Nowak, S.Matheson and N.MacLean

OBJECTIVE: To screen for regeneration in alfalfa cultivars agronomically suited to Atlantic Canada and to determine whether a correlation exists between regenerative ability and cold hardiness.

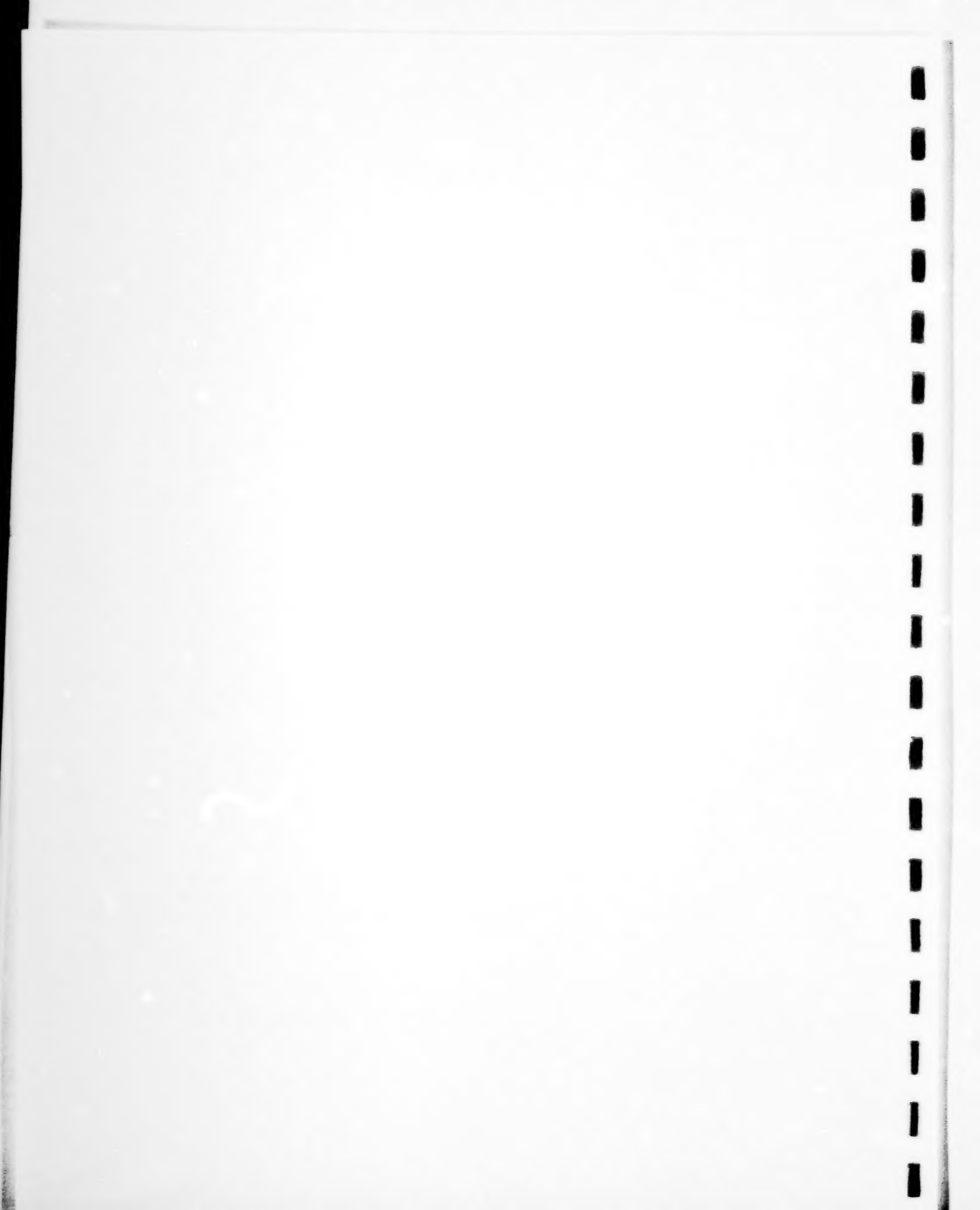
PROGRESS:

Development of cold hardy alfalfa adapted to Atlantic Canada conditions would increase its value as a forage. Cold tolerance screening of genotypes from regionally recommended cultivars has the potential to produce improves lines. Plant tissue culture provides an effective means of stress tolerance screening.

Emphasis was initially placed on screening genotypes for regenerative ability. Two alfalfa cultivars, suited to the climatic conditions of Atlantic Canada (Algonquin and Saranac) and three cold hardy prairie cultivars (Michigan, Peace and SC-3702) were chosen. Regenerative ability was determined using two protocol, a three step protocol using B5h callus, SH embryo induction and BOI2Y embryo development media and a two step protocol using BOII callus and BOI2Y embryo development media. Embryos were transferred to half-strength MS with 1% sucrose for plantlet development. Responses were similar for the two protocols. Many of the genotypes formed green "embryoid" regions. Only a small fraction of these regions developed into plantlets. Prairie cultivar SC-3702 exhibited the highest frequency of regeneration: 17.1% and 10.0% respectively for protocols one and two. Of the locally recommended cultivars, Algonquin was the most regenerative with 3.3% and 2.2% regeneration.

Apica, a selection from Saranac, is presently being screened and a procedure is being designed for hardening and freezing of in vitro grown plantlets. Preliminary experiments indicate that material grown in culture requires prolonged hardening.

This project was supported by the Canada-Nova Scotia Agri-Food Development Agreement.



Title: Effects of Applications of Sewage Sludge to Farm Lands on the Protein, Organic Matter and Heavy Metal Contents

Leader: K.S. MacLean

Objective: To determine the effect of the addition of sewage sludge to farm fields on the protein, organic matter, pH and heavy metal content of soils and plant tissue.

Progress:

A number of Pictou County farmers have been applying sewage sludge to farm land since 1978. Applications have been made according to the guidelines developed by a joint committee of the provincial departments of Agriculture, Environment and Health. The rate of sludge application was about 45 T/ha and consisted of a mixture of digested sludge, sawdust and ground limestone.

In 1985 and 1986 samples of soil and plant tissue were taken from sludge treated and untreated fields and analyzed for P, K, Ca, Mg, Zn, Cu, Ni, Pb, Cr, Hg, pH, organic matter and protein.

The results indicate that all soils had increased levels of heavy metals, pH and organic matter following sewage sludge treatment. Statistical analysis indicated that only Cu, Cr and Hg were significantly higher.

The soil nutrient element level was generally improved by sludge application. Farmers have verified the fact that increased yields were evident following sludge application and that this fertility effect seemed to be long lasting.

The levels of heavy metals in plant tissue increased for some elements following sludge application, while for others there was little or no change. Only Cu was significantly higher in the plant tissue. All plant tissue levels were within normal ranges and do not present a hazard to plant growth, animal or human health.

It is evident that heavy metal loadings to the soil, due to sludge applications, are only a fraction of the amounts considered to be maximum. It is therefore reasonable to suggest that a reapplication of sludge to the same fields can be made without exceeding the recommendation limits.

This project was supported by the Canada-Nova Scotia Agri-Food Development Agreement.

TITLE: Application of Hydrogen Cyanamide for Dormancy Breaking in Potato

LEADERS: D. Northcott¹ and J. Nowak²

OBJECTIVE: To study a potential application of hydrogen cyanamide for dormancy breaking in seed potato.

PROGRESS:

Several chemicals are used to release dormancy of seed potato. The most effective ones are, however, hazardous to apply. Hydrogen cyanamide, which in the past was used as a nitrogen fertilizer and is presently being applied in dormancy breaking of grape and raspberry buds, seemed to be a good candidate to examine. Potential application of this compound for dormancy breaking in seed potato was tested on cvs. Brador and Kennebec. The compound, when applied at 0.5-1 M for 1 min., effectively broke dormancy of the tubers. It also released apical dominance and increased the number of sprouts per tuber as well as the number of shoots emerged after planting. Such long exposure, however, caused tuber damage and sharply increased respiration. Shorter treatments (10 sec.) effectively induced sprouting in cv. Brador but was only slightly effective on cv. Kennebec. The titer of polamines dropped in the apical eyes of the tubers during the first 7 days after treatment and increased again 14 days after treatment in the tubers exposed to H_2CN_2 . The level of this compound in the control samples continued to drop.

This project was supported by Cyanamide Canada Inc.

¹Potato Marketing Board, Alberton, P.E.I.

²N.S.A.C., Department of Plant Science, Truro, N.S.

TITLE: Pilot test of urea-fish oil fatty acid complexes in ruminant nutrition.

LEADERS: R. G. Ackman, Technical University of Nova Scotia
N. L. Firth, Nova Scotia Agricultural College

OBJECTIVE: To assess as a ruminant feed a urea-fatty acid by-product remaining from an experimental process for the removal of omega-3 fatty acids from fish oils.

PROGRESS:

There is much interest in the value of omega-3 fatty acids for reducing thrombosis in humans. Dr. Robert Ackman, Technical University of Nova Scotia has developed a process for extracting these fatty acids from fish oils. The process involves complexing the unwanted omega-6 fatty acids and more saturated fatty acids with urea. This process is different from the one now in use in Europe.

The residual urea-fatty acid "Clathrate" is a by-product which would appear to have value in the feeding of ruminants. A three month trial was conducted to measure the acceptability and usefulness of this material when combined in growing lamb rations to supply 1% urea. Feed intakes and growth rates were the same with test and control rations and no difficulties were encountered.

This project was supported by NSERC.

TITLE: Selection for regeneration from red clover callus tissue

LEADERS: J. Nowak and N. MacLean

OBJECTIVE: Selection for red clover genotypes capable of regenerating plantlets from in vitro-grown callus tissue

PROGRESS:

Between April 1986 and March 1987, a total of 667 genotypes from cultivars Arlington, Florex, Marino, Renova and Tepa were screened for the ability to regenerate plantlets from hypocotyl-derived callus tissue. Epicotyl cultures were maintained separately. 357 of these genotypes were tested over 3 different, 3-step protocols: a B5-based protocol, a L2-based protocol, and a MS-based protocol. The MS-based protocol was most effective for root regeneration, while the L2-based protocol was most effective for producing semi-differentiated green regions within the calli. None of the callus cultures further differentiated to entire plantlets on any of the 3 recommended protocols.

Failure to regenerate plantlets, using recommended protocols, prompted testing of various media additives. Factors which were varied included benzyladenine, proline, spermine, yeast extract, picloram, ACC (1-aminocyclopropane-1-carboxylic acid) and AVG (aminoethoxyvinylglycine). Only one genotype (from cv. Florex) produced plantlets from the callus. The original hypocotyl had been sectioned and plated on B5-, L2-, and MS-based media. Only the callus on the B5-based media survived 2 subcultures and it was only after a further subculture to SPL medium (L2 salts + 0.2 mg/l benzyladenine + 0.002 mg/l picloram) that plantlet regeneration occurred. This regenerative culture has continued to form shoots and roots at a rapid rate. Plans are underway to evaluate the selection for ability to regenerate from cell suspension cultures, for cold stress tolerance of regenerated plantlets, for somaclonal variation, and for inheritance of the capacity for regeneration. A further 288 genotypes of Florex are presently being screened for regenerative ability following the procedure by which the first regenerative genotype was obtained.

HPLC analysis of the regenerating Florex culture revealed a very high level of the diamine putrescine. Putrescine inhibitors and promoters will be added to culture media in an effort to control initiation and termination of the regeneration process.

This project was supported by NSERC.



TITLE: Effect of Boron Nutrition on Glucosinolate Content in Crucifers

LEADER: H.-Y. Ju and J. Nowak

OBJECTIVE: To study the effect of foliar spray with boron on thiocyanate content and myrosinase activity in hydroponically grown 'Burpee White' radish

PROGRESS: Two week old 'Burpee White' radish seedlings were transplanted to plastic buckets containing 8 l of modified half strength Hoagland's solution. A low level of B (0.05 ppm) was maintained for one week until the size of the radish roots reached approximately 1 cm in diameter. At this stage, boron was removed from the solution and applied as a foliar spray with various concentrations of H_3BO_3 (0.0, 0.1, 1.0, 10.0, 100.0 and 1000.0 ppm B). The experiment was arranged in a randomized block design with four replicates and four plants per replicate. Three weeks after spraying the plants were harvested. Growth measurements were taken and thiocyanate content and myrosinase activity were determined. Inhibition of the root growth was recorded in the treatments 0-1 ppm of B. The highest yield of roots was obtained under 100 ppm of B.

The lowest level of thiocyanates was determined in the plants treated with 1000 ppm B. The amounts of 74.3 and 128.4 $\mu g/g$ DW were recorded respectively, for tops and roots of this combination, whereas 105.9-137.1 and 207.6-231.7 $\mu g/g$ DW concentrations were determined for tops and roots of the combinations receiving 0-100 ppm B.

There was no significant difference among the treatments with respect to the activity of myrosinase. The authors believe that higher thiocyanate content in the concentrations 0-100 ppm B is a result of higher levels of glucosinolates.

This project was supported by NSERC.